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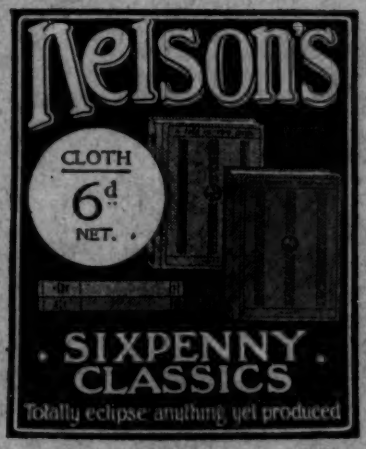

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THE

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A MONTHLY MAGAZINE AND REVIEW

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EDUCATION IN PARLIAMENT:

THE EDUCATION BILL AGAIN.

TOUJOURS the Bill. Three days a week. Three days of hard labour—penitentiary toil—for Mr. Birrell, Mr. Balfour, Sir W. Anson, Mr. Lough, and a few others (not to mention Mr. Morant and his adjutants "under the gallery"). Three sweltering days a week—dog-days; and sometimes the mental and moral thermometer higher than the Fahrenheit recorder. Up in the galleries we stand it as patiently as we can; we of the Press Gallery, and the good general public yonder in the Strangers' Gallery. And sometimes we relieve our tedium in the Press Gallery by gazing across to the Strangers' and Distinguished Strangers' Galleries, and studying the types we see there.

Several types. The Nonconformist type—sturdy, square, bearded—come to watch the victors cull the spoils of conquest. The Nonconformist pastor, not always with a white tie, and very seldom indeed with a white "dog-collar." The Nonconformist layman, who has "passively resisted," and doughtily fought at the general election. Curious to see the faces of these excellent men lengthen and lengthen as piece after piece is nibbled away from the Nonconformity of the Bill. Mr. Birrell is supposed to be a Nonconformist himself, and a Baptistean. Some of the zealous men in the Strangers' Gallery would like very much to take him out of the House for an hour and baptize him into Nonconformity again; for Mr. Birrell does not argue, debate, and announce decisions in a Nonconformist style at all. Recreant at heart, these honest critics think him. He talks like a Churchman sometimes, and sometimes even like a Roman Catholic. People of keen but narrow intellect fail to understand Mr. Birrell. He is too conciliatory for them; he is too much on both sides of the matter at once. Some of the listeners would like to try to "put some backbone into Birrell." They do not understand the mental attitude of a man who sees both sides of a question, sees them all at once, and, as a poet sang, sees them clearly and sees them whole.

Next to the Nonconformist sits the typical clergyman of the Established Church. He, too, fails to understand Mr. Birrell. Why, the man is talking smoothly, quietly, almost impartially, about this Bill, this unholy Bill, this confiscatory Bill, this Bill for public irreligion! Can it be possible that this is the great iconoclast—this man with the mobile face, good-humoured most often, but sometimes strangely stern—this man with the twitching fingers, the benevolent beaming Thackerayish spectacles, and the sudden, irresponsible, unbefore-thought-of quips of humour that relieve and salt the debate?

Observe in the corner the typical Cockney Labour voter, come to listen to Burns or "Keir." Impatient with all this twaddle about religious teaching is he; sceptical of the honesty of any of the parsons, Established or Free. A good downright denunciation all round is what he listens for—something to knock terrible daylight into the whole pretending, canting, white-collared lot! "Precious little about edication in this, eh, guvnor?" He turns to the typical teacher, sitting listening at his side.

The teacher nods assent. The teacher knows that even whispers are forbidden in the galleries. But the teacher would very much like indeed to speak aloud in the gallery—to speak from the gallery—to tell the well-meaning debaters below that all along they talk beside the question. The debate has never touched the core and essence of the matter, the teacher thinks. It is incredible how men can talk such nonsense, thinks the teacher. One would think that they had never been inside a public elementary school (and, indeed, they hadn't). First principles (and the wrong first principles); philosophical speculations devoid of any actuality; preposterous assertion of parental claims that

no parent ever put forth in the experience of the teacher; weary word-combats at full length about unessentials, and the guillotine down upon clauses which really matter, yet are never discussed at all. That is how the proceedings on the floor of the House look and sound to the listening, watching teacher.

Down in the arena below us the too many cooks stew and moil, concocting a brew and mess called an Education Bill. Mr. Birrell stirs it now and again, and ladles out a sample, a clause: "Taste it," says Mr. Birrell to the Irish members. "Wants a better mixture of holy water," they reply. He lifts the ladle to the lips of the Nonconformist. "Pah!" The Nonconformist thinks it smells of incense and smacks of simony. The Anglican turns away from it—"Too much Clifford," says he. The Labour man says "Secular's the only flavour," and the teacher cries that it isn't the taste of education at all.

And so we go on. We began again at it after Whitsuntide. The Opposition had protested from the first that they did not want the voluntary schools to be transferred to the Education Authorities. It was confiscation, they said, even though the transfer was only for the day school hours, and rent—market value rent—was to be paid for this limited user. But that was before Whitsuntide, on First Reading, Second Reading, and Clause 1. Now, after Whitsuntide, on Clause 2, Sir William Anson (oh, how he has bored us this session by his prim, precise, almost priggish way of speaking!), hight Don Universitus, moved to change "may" into "shall," so that voluntary schools *shall* be transferred, if their owners desire it.

Now the debate is transformed. It is no longer Anti-Confiscatorists protesting, it is Anti-Confiscatorists demanding that, in certain circumstances, their schools *shall* be "confiscated." But the Confiscatorists fight shy of being compulsorily led to "confiscate." Topsy-turvy, Gilbertian and Sullivanean, heels over head; jibes and jeers from the Government men, consequently. Elaborate explanations from the Opposition that there is really no ground for charges of inconsistency at all!

Jibes and jeers turned by militant Nonconformists against the Government when the debate has stumbled into Clause 4. This was a Nonconformist, anti-denominational, anti-denominational-test Bill, they had been told. Clause 4 runs away from these great principles. Clause 4 a Romanising, Anglicanising, teacher-denominational-testing clause. Under Clause 4 a denominational school may remain denominational, and the teachers may go on teaching catechisms. Clause 4 the triumph of Canterbury, the victory of Rome. And so on. *Da capo. Sforzando.* Then *da capo* again.

"May" and "shall" came into their eternal conflict again, about Clause 4. Such is the beautiful vagueness, yet careful precision, of English law that, under certain circumstances, may means shall and shall means may. The question was, What did the Government mean? Government said they meant compromise. They did not mean that a Local Education Authority *must*, in all circumstances, permit a denominational school to remain denominational, and be taught denominationally by the paid teachers, if the parents of four-fifths of the children wished it so; but the Government meant that, if the Local Authority wouldn't do that, there should be an appeal to the Board of Education, who might make them. But lest a Board of Education might be placed in face of the duty to send recalcitrant Local Authorities—mayor, aldermen, and corporation—to jail for *not* being so made, there would be an alternative—and here Dr. Macnamara and Mr. Yoxall began to go upon the war-path. The alternative was that a school about which this particular kind of quarrel arose might be ordered by the Board of Education to go outside local control and lose all rate aid, becoming a State-aided, voluntary contribution school again, as if there was no such thing as the Act of 1902 at all. And though Dr. Macnamara and Mr. Yoxall raged, protested, and declared that this contracting-out principle had been voted down on an amendment to Clause 4 weeks ago, a complacent Chairman of Committee put the question again, and Dr. Macnamara and Mr. Yoxall found themselves in the "No" lobby, and (like the teachers who had been writing to M.P.'s in favour of maintaining denominationalism) dished—for the time being, at least, quite dished.

The Government nearly found themselves dished on Clause 6. The Government had only sixteen of a majority in favour of their proposal that children should not be obliged to attend school at all till all religious lessons and observances were over. Mr. Tudor Walters, as an educationist, long a School Board member, and Chairman of the Association of Education Committees, thought children ought to be at school at nine o'clock. So did so many others that the Government nearly lost the clause. Everybody expects that the Bill will lose the clause in the House of Lords.

On Clause 7 the teachers were dished. Dr. Macnamara and Mr. Yoxall had amendments down, to provide for compensation or employment for all teachers now in voluntary schools, whatever might happen to these schools. They manœuvred, argued, protested, but in vain. No time was given to the question. Sir William Anson wanted to puzzle Mr. Lough (Mr. Birrell was absent, snatching a mouthful of food and another of air) with about fifty ingenious other questions, and Mr. Lough wanted to show his grasp of the subject by answering them all. Result, a scene of high comedy, the House in good humour, Mr. Balfour chaffing Mr. Lough till the guillotine fell, and the chance of discussing the parlous future of the voluntary school teachers was gone.

And so the House went on, through Clauses 8, and 9, and 10, and 11, and 12, and 13. Then Part II. of the Bill, a dreary waste of legal pages dealing with the technicalities of trust-deeds, was dropped. And so the first part of the Committee stage of the Bill came to an end.

Meantime wise members, who knew nothing and cared little about the technicalities of the control of education, kept out of the House, spent delicious hours on the terrace, and enjoyed their *dolce far niente* all the more by thinking of how the remnant of members, we reporters, and the listening public were sweltering in the House. A *posse* of German editors came into the gallery one day and stared and saw. If they could have understood what they heard, how they must have envied our way of doing things, and felt shame and regret when they remembered how education was managed in their beloved Fatherland! But "Rule Britannia!" and "Home, sweet Home!" after all.

BY MANY HANDS.

"Quot homines, tot sententiæ."

IT would be well for England if the strong and generally diffused interest in education which, as we learn from the Reports of the Commissioners on the first Mosely Educational Commission, is a well-marked feature in the United States of America, were prevalent here. There is no need of dwelling on the obvious value of national keenness for anything that is of importance in civilisation, but a less clearly seen drawback attaching to our comparative nonchalance in matters of education is this, that there is no body of lay opinion to control and guide the energies of the expert. As a result we have our present differences among the experts. The profession of teacher is not only not one, but it acts by sections of groups, without any common intent, in many important matters. Take the case of the Register of Teachers and Clause 36 of the Education Bill, proposing its abolition. What is the professional view of this clause? The Primary School teachers support it, the Secondary School teachers oppose it. Roughly, that is the situation. Public opinion on the subject being non-existent, the individual onlooker from outside concludes that registration is the hobby of the latter class—a thing opposed to the interests of the former. In the absence of a compacting force from outside, teachers work apart, though it is quite certain that a public keen for education would demand a register of properly-qualified teachers, and, looking broadly at the facts of the case, would define "properly qualified" as meaning "able to teach well." It would make short work of such questions as whether a non-graduate should be able to register, its object being to ensure that no one without good teaching power should have a hand in the educational rearing of the next generation, knowing well that on different grades different academic or quasi-academic qualifications are necessary, and that to demand the degree is to make the register a select roll composed of a small minority of "the army of light" for many years to come. To demand the degree is also to exclude the large majority of those teachers who have been trained from the register. As a jury brings the fresh whiff of common sense into the rarefied air of a law court, so would a body of eager lay opinion help the associations of teachers, living in a world of their own, to realise that a comprehensive roll of *professionally* prepared teachers is what the nation requires for the handling of its young and growing intellects.

NOT having the national interest in education that we desire, it is necessary that the profession should, at least, understand its own positions. Its sub-divisions breed misunderstandings and mutual caricature of their attitude. There are plenty of Primary School teachers who wish for *a* register, but hitherto they have confined their public action mainly to the abolition of the one that exists. There is many a Secondary School teacher who wishes for a different register from that which exists. But a body of national opinion, if now evolved, would have to arouse many a Primary School teacher to insist on *a* register, and to train many a Secondary School teacher to take a broader view than at present as to what a register should include. It seems that all associations of purely Secondary School teachers are anxious that some kind of register should be established. It also seems that all Primary School teachers are not unwilling that a comprehensive register should be set up. To these latter the positive value of a register of the profession, apart from any status which they may possess as quasi civil servants, has to be demonstrated. On the former the desirability of unity among those who "are separated only in the lowest things, while in the highest they are at one," and the impossibility of unity under the graduate qualification, should be enforced.

THERE is only one association of teachers which attempts, and is, by its constitution, qualified to attempt, to throw a bridge over the gulf which separates the one class of teachers from the other—the many in one body, and the fewer in many bodies—and that association is the Teachers' Guild. It has the difficult task of seeking to hold together those whose tendency is to fly apart—it relies for support mainly on "the public-spirited teacher," who sets essentials above accidents, and looks to the future as well as to the present. It fights the battle of the Kindergarten teacher and of all teachers of elements in Secondary Schools, as well as of the Primary teachers, who by sheer force of numbers can win material victories which only aggravate the situation as between them and the rest of the profession. The moral victories are reserved for those who can convince both camps in the direction of unity. As man is made, the champion of the deepest interests of all is too often the closest friend of none; but by a constant holding up of the ideal the true ends of civilisation are forwarded.

THE Guild has put forth a scheme of its own for a register which would admit the qualified teacher, without regard to his or her special position in the profession, to one alphabetical list. The scheme recognises the prevailing desire for some kind of minimum academic qualification for registration, and finds it in the level of the Government Certificate Examination or its equivalents. It exacts the same minimum professional qualification for all teachers, viz. that which is demanded under the permanent conditions established by the present register. The practical difficulty in connection with the adoption of the scheme lies, at present, in the fact that, for its own purposes, the Board of Education does not require such a register. But there are a great number of teachers who are not likely to come under any regulations of the Board, especially private school teachers, and, in the interest of all such, it is necessary to discover or to create an authority which shall have the charge of the register. The Guild proposes the establishment, for this and other purposes, of a Statutory Educational Council, as suggested in the Report of the Bryce Commission ten years ago. Such a Council is much wanted, to

exercise quasi-judicial functions in difficulties connected with the tenure of heads of schools and of assistants. It would be the right body to keep the register, and of its members a good proportion should be elected as soon as possible by the teachers on the register. Through such electoral rights the profession would gradually acquire a distinct status and a united voice on all matters which properly fall within its purview.

N.U.T. NOTES.

NO sooner is one election for the Union's "blue ribbon" determined, than preparations are put in hand for the next; and this year we have not had to wait long in order to ascertain what new competitor proposes to enter "the lists." The Birmingham Association—one of the very best in the country, by the way—has already nominated Mr. Alfred Flavell, a gentleman of great capacity and ability, and possessed of many delightful personal qualifications for the high office to which he now aspires. For many a year he has held a distinguished position amongst the leading educationists of the progressive district wherein he dwells, and in the comparatively remote period when he represented the Midland District Union on the Executive he achieved the unique distinction—for a D.U. representative—of being elected Vice-Chairman of a standing committee. He worthily represents the local teachers on the Education Committee of the city of Birmingham, where his felicity of diction and his comprehensive mastery of every phase of the Education question have naturally won the respect of his colleagues. If I may be allowed to state it, his one disqualification is his shortness of service as an elected Executive member. Miss Cleghorn's claims are much superior from this point of view, though possibly she may rest contented with the chairmanship of the B. and O. Council, to which she has just been called, and where her ready wit, great sympathy, and sound common-sense will greatly help on the noble work which she directs. In my humble judgment, the man who *ought* to be largely nominated for the Vice-Presidency of the Union, and who should attain the distinction within the next two years, is Mr. C. W. Hole, the Hackney and E. London member, whose nine years' work at Russell Square has been characterised by earnestness, soundness of view, ready grasp of great principles, and sterling grit. What does London say?

A New "V.P." Candidate.

I AM rapidly coming to the conclusion that it is impossible nowadays to discuss any Education Bill whatever, without more than a tincture of the detestable *odium theologicum*. Anyhow, we have had more than enough of "religious" discussions at the Executive during the past few months, and yet I have a great deal of sympathy for the principle of the motion introduced by Mr. W. B. Steer, to this effect:—

More Theology.

> "The Executive is of opinion that the arrangements for religious instruction existing in Provided schools are sufficient for all rate-aided, State-aided schools, and that facilities for distinctive dogmatic instruction are unnecessary, and calculated to continue the present sectarian strife, which has too long impeded the proper development of a national system of education."

Mr. Steer is one of the most trusted and talented of the class-teacher members of the Executive, and already marked out for the highest honours at the disposal of the N. F. A. T. He is a capital speaker, of the thoughtful type, with a clear grasp of all educational and professional questions. Indulging in no *ad captandum* oratory, he invariably lays his case out well, and he made an excellent speech—clear, forcible, logical—in advocating no "facilities" at all, but without gaining many adherents at Russell Square. As a matter of fact, he was speaking, in my judgment, to "deaf ears," and his motion was rejected, not on its merits, but because the Executive, for the nonce, followed the counsel of "hang theology" Rodgers, having had a surfeit at the April and May meetings. Mr. Steer is not afraid of hitting out "straight from the shoulder"; and who that is at all conversant with educational discussions to-day will attempt to deny the truth of the following? "At present, there seemed to be a section of teachers who desired to make themselves exclusive by the retention of denominationalism in their schools, but who at the same time felt that they should not be debarred from promotion in the unsectarian schools." This is "touching the spot" *à toute outrance*, if you like.

LIKE "that blessed word Mesopotamia," the terms "devolution" and "decentralisation" are comfortable, high-sounding, and pleasing; and yet, when one comes to close quarters with them, they are wholly past comprehension. For the past two or three years the East Yorkshire County Association has been hatching what is euphemistically described as "a scheme of reorganisation of the Union," the main lines of which are (1) Local Associations, (2) County Associations, (3) Electoral District Committees, (4) a National Council, (5) an Executive. The Worcester City Association, on the Scarborough Conference Agenda, threw additional light on the above scheme, and amplified it thus:—

Devolution.

(*a*) *County Associations*, formed of combinations of Local Associations. (The country to be divided into twelve electoral districts coterminous with county areas, and as nearly as possible equal in membership.)

(*b*) *A Committee of twenty members*, elected annually by the County Association in each electoral district—apportioned to them in proportion to their membership.

(*c*) These twelve sections of twenty members to be combined to form a *General Committee*, of 240 members, which shall meet at least twice a year to discuss and decide lines of policy, Agenda for Conference, etc.

(*d*) An *Executive* of thirty-six members, to be elected annually, twelve being elected by and from the various sections of twenty—one by and from each—and twenty-four members elected by the members of the Union, in the proportion of two from each electoral district.

What the cost of the above scheme would be to the Union, whose General Fund balance-sheet is always in an unsatisfactory condition, I shiver to contemplate.

But what *good* would come of all this additional machinery is, to me, a greater puzzle still. The reformers say, "Give the County Associations more work to do!" and one asks in vain, "*What* can be devolved?" Looking through the functions of the Executive's seven standing committees, I affirm, without any hesitation, that the work of the Education, Finance, Law, Tenure, and Parliamentary Committees and Examinations Board *must* be retained at headquarters. Possibly some of the duties of the Organisation Committee might easily be passed on, although much would necessarily remain behind. It is only when one comes to tight grips, as it were, with a question that one realises how much (or how little) there is in a taking idea or phrase. The friends of devolution are, I understand, especially anxious to take over the Union's Tenure work, and this branch of Union activity is, I fervently hope, the *last* which the Central Authority will be prepared to relinquish or delegate.

❧ ❧ ❧

Mr. Ernest Gray, M.A.

WHEN Mr. Ernest Gray was engulfed, in mid-January last, in the maelström which temporarily terminated the career of so many gentlemen of much greater political pretensions than he, there were hardly a score amongst the sixty thousand members of the Union who did not heave a sigh of regret at his defeat. I am not ashamed to confess that regarding North-west Ham, I was an optimist until the very declaration of the poll. I was *au courant* with the magnificent work both he and Mrs. Gray had done in the constituency. I knew at first hand his marvellous powers as an organiser, and I hoped much from the gratitude of the honest, hard-headed *ouvriers* whose interests he had perpetually striven to further. But I had reckoned without the Manchester *débâcle* a day or two earlier, and so we are denied the spectacle—not for very long, I trust—of a Conservative teacher on the Speaker's left hand. I had anticipated, with some interest, the *rôle* of Mr. Gray as a member of His Majesty's Opposition, and had pictured to myself how he would revel in the guerilla-like onslaughts so easy to the free lance, but denied to the pledged supporter of the Government. However, the hope was vain; and, for the moment, his career of usefulness is confined to a humbler sphere than the purlieus of St. Stephen's. He has not been allowed to leave his old constituency without many delightful and tangible tokens of esteem and affectionate regard. A happy thought of the organisers of the "testimonial"—I hate the word, but the poverty of the language prevents my using another—decreed that each of the Ward Associations, and the local habitation of the Primrose League, should present its own gift, and thus Mr. Gray became possessed of a variety of valuable, useful, artistic, and personal articles. A travelling-bag, liqueur cabinet, pair of Zeis binocular glasses, coloured engravings, choice and costly books, gem scarf-pins, handsome pedestals with pots to match, were some of the souvenirs that will keep West Ham's memory green; whilst Mr. Gray's charming helpmate was the happy recipient of a dressing-bag and diamond and sapphire dress-ring. Mr. Gray is far and away the best linguist at the headquarters of the Union, and hence *éditions de luxe* of such works as Cervantes' *Don Quixote*, Dante's *La Divina Commedia*, Goethe's Works, Molière's Works, and Montaigne's Essays would be singularly acceptable and *àpropos*. The sentiments expressed during the various presentations would have touched the hearts of individuals much less sensitive than Mr. and Mrs. Gray, and I heartily congratulate them both on the memorable and felicitous occasion.

❧ ❧ ❧

The Sword of the Press.

AS everybody knows, Mr. Ernest Gray's official designation at the Union offices is "Secretary to Education Committee," and most admirably are his responsible duties fulfilled. I distinctly remember the day when we had at Russell Square at least three committees dealing with educational matters, viz.—(1) Education, (2) Evening Continuation, (3) Secondary and Technical; but now the functions of all three are combined in one great Education Committee, easily the most important of the Executive's standing committees, and it is Mr. Gray's *métier* to carry out its decisions. Practically, every month he is required to submit draft memoranda on two or three "burning questions" of the day, but he is not by any means satisfied with this. He is ever on the *qui vive* to make work for himself and his committee, and very rarely does he hazard a suggestion that does not prove, on examination and after discussion, worthy of being taken up. It may be recollected that Mr. Gray was the initiator of the scheme of Parliamentary Correspondents, which has, on many vital occasions, proved invaluable, though, oddly enough, there was plenty of misgiving in the early days, many associations declining positively to touch it, on the ground that the N.U.T. had "nothing to do with politics." Now, Mr. Gray has submitted a scheme for the utilisation of the wealth of precious educational material accumulating and accumulated in the Union's offices, which bids fair to go far towards creating a more healthy public opinion on matters concerning the welfare of the nation's schools, and particularly the primary schools. These columns are not, of course, the vehicle for giving details of the scheme, which, however, if heartily taken up, should ultimately do much to secure the support of the public for greatly needed reforms. Probably Mr. Gray is correct in his statement to the Executive that—"Experience has shown us that improvements in education are very frequently delayed, not through the apathy, or even lack of sympathy, of members of the Local Authority, but because that Authority fear that progress would not receive the assent of the electors." Hundreds of teachers throughout the country wield a clear and facile pen, and it is not difficult to estimate roughly what effect a rousing contribution on, for instance, "Large Classes," might have, if inserted in every newspaper in the land.

A. C.

Mr. Morley's Prose Poem.—Mr. John Morley has told an amusing story of his school-days. "When I was at school at Cheltenham," he said, "I once wrote what I wished to be a prize poem, but it was unsuccessful. The headmaster, however, said to me, 'I am glad you have composed this poem, because it shows all the elements of a sound prose style.' That observation wounded me at the time," added Mr. Morley, "but I afterwards was cute enough to perceive its full significance. Though in one sense it was an extinguisher, in another it was an incentive."

THE TRAINING OF TEACHERS IN SCOTLAND.

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PRIMARY EDUCATION IN SPAIN.

THE close connection which has been established between the royal houses of England and Spain has given that country an additional interest to Englishmen. For this reason a short sketch of the state of primary instruction in the land ruled over by King Alfonso will probably interest our readers. For the subject-matter of this sketch we are indebted to the interesting article of M. Mérimée in a late number of the *Revue Pédagogique*.

Five years ago a Ministry of Public Instruction was established in Spain, but so far the only good thing which has resulted from the creation of that office has been the issue every year of what we should call a "Blue Book." If this annual publication is not a record of progress, it at any rate puts into the hands of patriotic Spaniards, anxious to elevate their country in the scale of nations, official and authoritative data, showing what are the evils which have to be combated in order to raise public instruction to a higher level.

A great obstacle in the way of permanent social and intellectual improvement in Spain is the frequent change of ministry. There have been no less than eight Ministers of Public Instruction in the period from January 1903 to December 1905. These have not been wanting in zeal. Working with the consciousness that their tenure of office would be but of short duration, they have in all haste elaborated schemes of reform which, officially speaking, they have not lived to carry into execution. That there is ample work to be done by a Minister of Public Instruction is evidenced by the fact that Spain counts no less than 66 per cent. of illiterates. The difficulties which have to be surmounted are multiple and complex. A paternal but strong Government may make short work of the little esteem in which education is held in Spain by adopting the principle of compulsion, and founding sufficient schools; but the teaching profession has to be raised in the public estimation by giving its members more secure positions, and by largely increasing their remuneration, before a sufficient number of capable men will come forward to help in the work of national regeneration. Furthermore, by the substitution of more rational methods of instruction for those in vogue, the intellect of Spain must be shaken out of the stagnation which has overtaken it—a stagnation which has been intensified and perpetuated by the Chinese practice of learning text-books by heart, a practice common in Spanish schools of all grades.

Considering the extent of the surface of Spain, and that a great proportion of the population lives in small and scattered villages, a large number of schools would be required in order effectively to carry out the principle of compulsion. The total number of schools existing, according to official statistics, in 1903 was 23,058. Obviously inadequate for the needs of Spain as this number of schools is, the official figures do not disclose the full extent of the deficiency. It will hardly be credited by our readers, but it is nevertheless a fact, admitted in official documents, that many of these schools have no existence at all. Thus, 116 *schools are returned as existing in the province of Oviedo*, but it is subsequently explained that 113 *of these are closed because there are no teachers for them*. Again, in the neighbouring province of Leon, out of the 150 schools which exist officially, 110 are closed because there are no teachers for them, 26 because there is no building in which to accommodate the scholars, and 6 for reasons not specified. *Thus, out of the* 150 *schools in the return, only* 8 *are actually in existence.*

There exist at present Training Colleges for teachers in each University town. Others may be established in the capitals of provinces, but in this case it is the province, and not the State, which pays the cost. In Madrid there exists also a Central Normal School for the purpose of training professors for the Training Colleges. As the highest salary an elementary teacher may ever hope to get is about 2500 pesetas (less than £75), it may be imagined that there is nothing which at all resembles a rush to those institutions. Indeed, it is very often the individual who sees no hope of getting a living in any other way who becomes a teacher. Having finished his training, the ex-student becomes dignified with the official title of "Elementary Teacher" (the title is longer and more imposing in Spanish), but no income attaches to the high-sounding designation which is his. He must fight in open competition to secure a situation, and he may find too often that the selection will fall on the candidate who is not above employing the most dishonourable methods. Having gained a situation, he is not likely to be disturbed by inspectors' visits, as these officials can hardly be said to exist. The number of inspectors pans out on the average to one for each of Spain's vast provinces. Nor is it likely he will get much advice of value from these functionaries, as, to vary a well-known epigram, what they know about schools and education can hardly be considered knowledge. If the teacher's lot happens to be cast in a town, he may get into more frequent contact with his superiors.

A peculiarity of the administration of elementary education in Spain is that in the large towns the government of the schools is confided to officials called "Royal Delegates." These officials inspect the schools, appoint the teachers, grant them leave of absence, and, where necessary, suspend or dismiss them from office. These individuals are appointed from among the leading inhabitants of the towns in which they exercise their functions, and local intrigue plays a pretty prominent part in their selection. They need know nothing of educational methods or of school management, and in only a few cases do these qualifications exist.

In order to gain a correct idea of the actual amount of State support given to schools in Spain, one must remember a curious peculiarity of payments made from the Spanish Treasury. Suppose a school is put down as receiving 100 pesetas annually from the State. In reality it only receives 88·3 pesetas. Payments from the Treasury pay a duty of 1·2 per cent. Then there is a registration fee of ·5 per cent., and finally a deduction of 10 per cent. is made for the Pension Fund for State officials.

Of the eight Ministers of Public Instruction who held office during the years 1903–5, three distinguished themselves by the elaboration of schemes of reform. Señor Manuel Allendesalazar proposed to make attendance at school obligatory from the age of six to that of twelve years. Education should be gratuitous only for very poor children. Teachers should be entitled to a house rent-free, to payments from the parents of scholars, with the exception of those receiving free education, and to a salary from State sources varying from 500 pesetas in villages of 300 inhabitants to 2500 pesetas in towns of over

40,000 inhabitants. Teachers should be chosen by open competition, and should be required to give practical proofs of their technical ability before a jury. As an alternative they should be appointed by the Rector of the Academy of the district, who should have regard to their qualifications and testimonials. Furthermore, inspectors were to be appointed, but as their salaries were fixed at 3000 pesetas (£89) per annum, it could not be expected that men who would command the respect of the teachers would offer themselves for appointment.

To Señor Allendesalazar succeeded Señor Juan de la Cierva y Peñafiel. With creditable candour, Señor de la Cierva recognises that Spain is very backward in matters of education, and that the progress of other nations has been in proportion to the care they have devoted to this important subject. He proposed to simplify the method of payment to teachers by abolishing parents' payments, and making them functionaries with salaries going up to 3000 pesetas. Inspectors to the number of 150 were to be appointed. These were to inspect each school at least once a year, and to have power to inflict official punishments on unworthy teachers. Their salaries, too, were to be fixed at a higher rate than that contemplated by his predecessor. Furthermore, the period of study in Training Colleges was to be raised to four years.

Señor de la Cierva, the most thorough-going reformer Spain has yet had, was succeeded by Señor Cortezo, a timorous man, who wished to please everybody. He propounded a list of reforms which might mean anything or nothing, and in the same spirit made a pronouncement on the remuneration of teachers which might be taken as authority to local authorities to continue the odious system of exacting contributions from parents to help to make up the teacher's salary.

So far general elementary education in Spain has not got beyond the stage of proposals; but it must be counted as progress that it has got so far. May the reign of King Alfonso go down to history as the one in which this most important step towards Spain's regeneration was taken. W. T. T.

THE FRENCH ELEMENTARY TEACHER:

SOME THINGS WE CAN TEACH HIM.

BY BENJAMIN DUMVILLE, M.A., L.C.P.

II.

REFERENCE has already been made to the long hours in the French elementary schools. There are three in the morning, and the same number in the afternoon. In most town schools there is a further period of two hours, during which those boys whose parents wish it may remain for preparation of lessons and writing of exercises, instead of doing this work at home. The teachers receive extra payment for this, and in most cases all are not required every day. It should further be stated that about half-an-hour's recreation is enjoyed before recommencing work. We get thus a total of eight hours per day, during which a large number of the boys are under the supervision of their master.

In most large towns, on leaving school, the boys are accompanied by their teachers. There is no remaining behind in the playground. The lads are arranged in sections according to the districts in which they live, and one teacher takes charge of each band. They march out and along the streets, leaving the ranks as they reach their homes or the turnings leading to them. It seems to be a recognised thing that the streets are not fit places for children. All the more shame to the streets! One is reminded of a well-known poem which figures in many English reading-books, commencing:—

> "Down the street with laughter and shout,
> Glad in the freedom of school let out,
> Came the boys, like a flock of sheep."

No such pleasing sight is possible in many French towns. The following quotations from an article on the subject by a Lyons teacher (in the *Bulletin Mensuel de l'Union Pédagogique du Rhône*) will give some idea of the feelings of these hard-working servants of the State:—

"Morning school is over. I come down into the playground. . . . I breathe freely. Is it not the open air, liberty, calm and rest, after three hours of almost unbroken nervous tension? Wrong again. . . . I must recommence my supervision, for the ranks are being formed. Forward!

"We march past *M. le Directeur*, who critically surveys us. We go out, and I accompany for ten minutes the eighty children whose route lies to the north-west.

. . . . . .

"Reproofs, reprimands, punishments. . . . Lessons are over, but outside the session continues.

"Passing along the streets, I am the object of ironical grins on the part of various people, who evidently get a little amusement at my expense. The pupils also do the same, but, being obliged to observe a prudent reticence, they have to be contented with internal jubilation."

Then, after describing the difficulties and dangers of controlling this large band in the crowded streets, the writer concludes:—

"But I shall not always be successful in safeguarding the existence of these thoughtless brats. Some day or other . . . I shall pick up a youngster seriously damaged by the passage of an unexpected vehicle. The parents will lay the blame on me, and I shall have to bear the expense and trouble of an action at law. . . ."

In addition, those who stay for dinner at school require to be overlooked; and, lastly, there is the *garderie du jeudi*, of which mention has already been made. Can it be wondered at that both teacher and pupil get a little tired of each other? Ten hours of continual companionship every day would be a severe test of many far closer relationships. Familiarity breeds contempt, and one of the reasons of the weaker control of the French teacher is that he is too long with his boys.

But these long hours have a far more serious effect on the general work of the school. Both boys and teachers have insufficient open-air exercise. The depression of the teacher and the enervation of the boys act and react on each other, and produce in many cases a most unwholesome atmosphere. In order that the teacher may come to his class with that cheerful alacrity which is so essential in school work, it is necessary that he should get right away from his boys at frequent intervals. It is only by considering the teacher as an end in himself that we can make of him a highly

efficient means of education. This point of view is sadly neglected in France. In Marseilles last year it was actually proposed by a member of the Council that a much wider extension should be given to this supervision. The children of working-class parents were to be received by the teacher two hours before morning school, and to be kept still longer in the evening, so that the parents might be relieved of responsibility during the whole day; further, not only were they to be taken charge of on Thursdays, but on Sundays also, so that the parents might enjoy the day of rest in peace. To be thorough, this friend of the parents wanted to have the children supervised throughout all the holidays. To liberate the parents completely, there appears to be only one remaining thing—the installation of beds in the school. As one teacher expressed it, soon they will be able to declare in France: "*C'est aux parents d'avoir des enfants; c'est à l'instituteur à faire le reste!*"

Although the *interrogation individuelle* of which we have spoken is an excellent procedure, it is overdone in most French schools. The attention of the teacher is so much and so often concentrated on individual pupils that he fails to maintain that general grip of the class which is such an excellent feature of English class management. Oral questioning of the whole class, causing all the boys to search for the answer, and requiring "hands up," is almost unknown in some French schools. One teacher, to whom the writer described the method as a novelty, raised the absurd objection that he did not intend his boys to practise gymnastics at the wrong time. Even when a teacher does undertake to question his class, so accustomed is he to the individual form of questioning that he often nominates the pupil who is to answer *before framing his question*. The consequence is that the remainder of the boys, unless they are greatly interested, are quite indifferent, and often fall into disorder. The worst form of all, which is nevertheless frequently to be met with, is for the master to call out all the boys he intends to question before he commences. He usually confines his attention to these, letting the others take care of themselves. No account seems to be taken of the consideration that many boys would be induced to show at least a semblance of attention if they feared that indifference might result in their being pounced upon.

At a time when many are crying out for secular schools in England, it is worth while inquiring into the results which have already been obtained in France. The temper of the French schools can be judged by the changing fortunes of one of the best known books on moral instruction. More than twenty years ago Compayré published a book on this subject for elementary schools. In this little work an attempt was made to found morals on the reason. No reference was made to the Bible. But the existence of a Supreme Being and of an after-life was inferred from the evidence of design in nature, and from the necessity of sanctions for conduct. This, however, was insufficient to please the Catholic Church, and by her the book was condemned. It has had, nevertheless, a long period of success. Yet now its circulation is on the decline. But for a totally different reason. Such progress has been made by free-thought in France that in many quarters the book, which was once attacked for its godlessness, is now proscribed because it goes so far as to mention the name of God. In Lyons, a strong socialistic and freethinking centre, it is absolutely forbidden in the schools.

A majority of the elementary teachers seem to be in sympathy with this movement. Only among the older members of the profession is there any real respect for the Church. Although strict neutrality is the motto, the idea in some quarters seems to be that the teachers are the soldiers of the Republic, appointed to fight the common enemy. The following extract, translated from a teachers' journal (*Bulletin Mensuel de l'Union Pédagogique du Rhône*), illustrates very well the present state of affairs:—

"The other day, the school of V. was called upon to accompany one of its pupils to his last resting-place. While the pupils and myself were taking our places in the funeral procession, the man in black, half-covered with white for the occasion, also took his place; not out of sympathy, I suppose, nor because of duty, but by profession. However that may be, the promiscuousness of these two social incompatibilities, the secular school and the Church, raised in my mind a host of reflections and perplexities. What shall be my attitude?

"At first it appeared simple. If I were here on my own account, said I to myself, I would not be present at the religious ceremony; but I am on duty, under orders, and it is not my place to give vent to my own opinion. The remains of this child belong at least as much to the school as to the Church: therefore we will follow them right through. Besides, would it not be, in some measure, doing injury to the stricken family to say to it by this action: Our sympathy for you stops at the church door?

"However, at a given moment, I noticed in the ranks some scholars whose families are notorious freethinkers. With that, the idea of duty arrested me with the greatest distinctness, and all hesitation ceased. The procession had stopped; the little coffin was carried into the sacred precincts; I lined up my pupils on the pavement, and we waited for them to come out. The immediate consequence of my abstention was that inside a great storm burst out (a storm of good augury); the man of peace and of good-will, without respect either for the place or for the circumstances, went into a great rage against the impiety of the times, and especially of the secular teachers. On coming out, he approached me in a surly manner, and demanded of me in a rough tone: 'Why didn't you tell your children to go in? Is there anything in your regulations which forbids it?' It was not the moment to commence a discussion, which, besides, he would not have been willing to listen to. I confined myself, therefore, to remarking: 'I do not think the regulations have provided for such a case.'

"Now that I have recovered from my emotions, I wish to explain the matter, not to the priest, but to myself and to my colleagues, of whom a few, perhaps, will blame me. . . ."

To fill the void created by the removal of the Bible, moral instruction is prescribed in every school. It is significant that this teaching is closely allied to civic instruction, the two being often treated in the same book, and being regarded as almost inseparable.

It is not necessary to go into the details of this instruction. All that will be attempted is to characterise the teaching as a whole. The whole of the duties of man, including love and respect to parents and teachers, are impressed on the young children. Where possible, anecdotes are used to drive home the moral. The fol-

lowing general plan of a lesson illustrates the mode of procedure:—

(1) *Questions on the preceding lesson.*
  (*a*) Recitation of summary (which has been learned by heart).
  (*b*) Oral reproduction of the tale which was given as an example.
  (*c*) General questions.
(2) *New Lesson.*
  (*a*) Anecdotes read or related by the teacher.
  (*b*) Questions on the tale. Moral to be drawn.
  (*c*) Cause the children to recite, if possible, a poem or fable on the subject.
  (*d*) Maxims and proverbs to be commented upon.
(3) *Summary.*
  N.B.—Must be short and precise, and will figure in the notes. It will be written on the blackboard, so that the pupils will be able to copy it without mistake.

From this, some idea of the artificial character of this teaching can be formed. The French seem to imagine that it is possible to reason children into the state of virtue. They are evidently impressed with the Socratic notion that virtue is knowledge. The supreme importance of the gradual formation of good habits seems to be ignored. When the teacher is heard solemnly telling the children that it is their duty to love him (the teacher), one can scarcely refrain from laughing. Would it not be better for him to adopt in silence the maxim that it is his duty to make himself loved and respected, as far as that is possible in school?

The purely theoretical character of this teaching is sometimes made painfully evident. Let us take truthfulness as an example. After a lesson on this subject in the morning, one will hear the teacher question a boy with unconcealed distrust, and then, being dissatisfied with his reply, exclaim: "He is lying! He is always lying;" proceeding forthwith with the lesson in hand as if nothing had happened. The following is another example (verbatim):—

Master. You have been drinking!

Pupil. No, sir!

Master. Why, you are just wiping your mouth after it.

Pupil. ——!

Master. Liar! (Goes on with the work.)

And again:—

Pupil (in answer to a question). No, sir!

Master. Yes, sir! It is very wicked, is lying. I have already told you so many times. (Proceeds.)

The writer was present on one occasion when the mother of a boy came up to ask why he had not received the usual *témoignage de satisfaction* at the end of the week. She stated that her son had given her as an excuse that he had just failed to reach the necessary minimum of marks, but that she believed he was lying. The head-master consulted his mark-book, corroborated the boy's statement, and the woman went away satisfied. Neither parent nor teacher seemed to understand that, in openly proclaiming their disbelief in the boy's truthfulness, they were doing him more harm than all the *témoignages* in the world can do of good. The same head-master said that in the months of June and July, which are very hot in this part of France, he tries to stimulate the boys to work by announcing that all marks will be doubled, and will thus have twice the ordinary effect in determining the order of merit. On being asked whether he adhered to his promise, he replied in the negative, defending himself by remarking that the boys did not know how the marks were apportioned, and that, after all, the end justifies the means.

In some schools it is a common practice to send reports to the parents *by post*. Some head-masters display further ingenuity by posting them so that they arrive when the boys are at school, and cannot intercept them. Instead of dishonesty in this matter being considered as an awful exception, it is the honest lad who is looked upon as a *rara avis*. Now, part of the punishment which a bad report should inflict is the fact that the boy has to take it home and present it to his parents himself. This course, which is common in England, is impossible in the cases under consideration.

It is not to be inferred that all this failure in the moral teaching is to be attributed to the absence of the Bible from the schools. If, however, the experiment may be said to have had anything approaching a fair trial, it may perhaps be concluded that the time has not arrived to separate completely morality from religion—at any rate for the people. The "practical reason" of Kant may be of great force when associated with the high moral character of that philosopher. Until such characters can be formed in the case of the children of the masses, it seems well to let religion maintain its influence. Whether religion, with what moralising influence it has, should be taught in school by the teacher, or whether other arrangements should be made, may still remain an open question, which it is not the object of this paper to discuss. It seems, at any rate, certain that the general tone of the school, as set by the masters in their relations with the scholars, at all times and in all subjects, is a far more important factor in moral education than any definite attempt to inculcate lifeless formulæ.

Another tendency of French elementary teaching which seems to require correction is the worship of words and of books. At the end of most lessons (in history, morals, geography, civic instruction, elementary science, etc.) a summary is written out by the boys and learned by heart, to be repeated at the beginning of the next lesson on the same subject. It is, of course, undesirable to dissociate words from things. In the case of abstract nouns especially, the word plays an important part in fixing the thing (the idea). But it is possible to lay too much stress on words, and to neglect the real knowledge which they represent. This fault appears to be very marked in French schools. Lesson after lesson begins with a dull repetition of a summary of the previous lesson, with few, if any, probing questions on the meaning. The following is an example of one of these summaries at the end of a lesson on intemperance:—

"Drunkenness is one of the most shameful vices which man can contract. It ruins the health, weakens the intelligence, and destroys the noble sentiments. Thus the drunkard is a scourge to himself, to his family, to society, and an object of contempt to everybody. Intemperance is a veritable plague for the country, since it peoples at the same time the hospitals and the prisons. He who knows its effects and, in spite of that, indulges in it, is absolutely without excuse."

Such a method appears far too verbal. By all means let the teacher dictate a summary if he wishes. But it ought not to be learned by heart. The pupils cannot retain even a small number of these summaries. By requiring them to be committed to memory day by day, the teacher is cultivating that artificial type of memory which may be necessary for lawyers, but which is injurious to children. Let them learn by heart pieces of poetry, and even prose extracts from good authors. But let these be learned so that they are retained.

Here, again, the French teachers make a grave mistake. During the year as many as a dozen, or even twenty pieces, are learned by heart. The consequence is that almost all are forgotten, and one of the principal objects of this work is lost—namely, the storing of the mind with a few masterpieces which shall remain, if not throughout life, at any rate for a large portion of it. Perhaps English teachers commit the opposite error, especially in the lower classes. Here it is not infrequent to find a teacher hammering away at one small extract during several months, till both he and his pupils are heartily tired of it. Nothing will bear indefinite repetition without losing its charm. The problem is to strike the happy medium which, while ensuring that the pieces are thoroughly mastered and retained, avoids repletion.

It is, no doubt, sound pedagogy to insist that the children should be led to talk and to express themselves with correctness and precision. Many French teachers, however, become the slaves of this principle, and are often satisfied with mere words. In a class corresponding to Standard I., for example, a head-master was found solemnly asking for definitions of *vowel* and *consonant*. He gave, by the way, absolutely false definitions. When the advisability of his proceeding was called in question, he explained that the words *vowel* and *consonant* were used in the grammatical rules which were soon to follow. It was suggested that, even admitting that the children were ready for these rules (a very doubtful point, seeing that they could not read, and that, therefore, the time given to grammar might have been more profitably spent in reading), the words *vowel* and *consonant* could be defined by extension; *a*, *e*, *i*, etc., being called vowels, the rest consonants. His final argument was that he had pursued this course for over thirty years, and had succeeded as well as his neighbours.

In a class corresponding to our Standard II. the following questions and replies were heard:—

Master. What is *une plume*?

Pupil. *Une plume* is an object with which we write.

Master. What is the word *plume*?

Pupil. The word *plume* is a noun.

Master. Of what gender?

Pupil. Feminine.

Master. Why?

Pupil. Because usage allows us to say, "*une* plume."

At first one is inclined to be delighted with the apparent intelligence of these children. But there follow exactly the same series of questions with respect to *tableau*, *pupitre*, *table*, *fenêtre*, *banc*, *plancher*, *plafond*, and a host of other words, until the pupils are in a state of indifference and disgust. One is reminded of a tale with respect to a certain German emperor who had in his army some regiments whose mother-tongue was French. He had the habit of inspecting them once a year, and he always put three questions in German to the officers, in the following order:—

"What is your age?"

"How long have you been in the army?"

"Do the food and the pay suit you?"

Those who did not understand German learned the three replies by heart in the order of the questions. Unfortunately, on one occasion, the emperor changed the order and commenced: "How long have you been in the army?" He received the reply: "Twenty-two years, sire." "But how old are you?" he demanded. "Two years, sire," was the reply. "One of us is a fool!" he exclaimed in anger. "Both, sire," politely replied the officer. Exactly the same kind of mistake was made by these pupils. In answer to one of the questions, they often gave the answer appropriate to another.

The same anxiety for words is betrayed in other subjects. In arithmetic, for instance, young boys learn by heart and repeat frequently the following definition:—

Division is—

(1) The operation by which, after having divided a number into as many equal parts as there are unities in another number, we find out how many unities there are in each of the parts.
Example: 180 francs divided among 9 persons? Each person receives 20 francs.

(2) The operation by which we find out how many times one number is contained in another.
Example: In 24 metres how many times are 3 metres contained? 8 times.

(3) The operation by which a product being given and one of its factors, we find out the other factor.
Example: 15 is the product of two factors of which 5 is one; what is the other? 3.

An inspector, after hearing the recitation of this elaborate definition, asks the pupil: "What is the use of division?" The boy stares at him in amazement, having learned no reply to such a question.

That this criticism of the French is not left entirely to foreigners may be illustrated by the words of M. Gabriel Hanotaux in his suggestive book, *Du Choix d'une Carrière*. He says: "With us, words kill the realities. A verbal nation, if ever there was one, we pay attention to preaching and systematisation, and not to facts and evidence."

In almost every subject, even in the lower classes, the boys have a text-book. The teacher relies upon this almost entirely. The instruction partakes too much of the character of that which is found in inferior secondary and private schools, where the learning and reciting of portions of the text-book are the foundation of the instruction. While variety of books is good, too many should not be in use at the same time. Otherwise the boys are overwhelmed with the multiplicity, and fail to understand any. Books should be the servants, not the masters, of these little boys.

In conclusion, a few words on the relations existing between head and assistant teachers may not be out of place. In most large schools in France the head-master is, as with us, relieved of class duty. He does not, however, appear to keep as much in touch with the work as in English schools. In the past he has displayed lack of sympathy for his subordinates, and has developed so tyrannical a disposition that the animosity of the assistants has been widely aroused. It is no

uncommon thing, even at the present time, to see a head-master walk into a classroom with his hat on, requiring the boys to spring up and salute him, even if the assistant is in the middle of a sentence. He thinks nothing of interrupting the teacher, and of correcting him before his class. One cannot help feeling that France, with its republican shell, is monarchical to the core.

As a consequence, in many parts of France the assistants are agitating for the suppression of the position of head teacher. They maintain that each assistant should be absolute master in his own class, and that the general organisation of the school should be in the hands of a Teachers' Council.

In some parts of France a council has already been instituted. The head teacher has to meet his assistants once a month and discuss the conduct of the school with them. Most head-masters are opposed to this practice. Yet, if it is undertaken in the interests of education and of the school, nothing could be more beneficial than such exchange of ideas. Unfortunately, neither those who demand it nor those who refuse are actuated by the purest motives. We can congratulate ourselves that difficulties of this kind are rare in England, where, to the credit of the head-masters, it must be said that they use considerable tact in exercising their authority.

SPECIAL REPORT ON SCHOOL TRAINING FOR THE HOME DUTIES OF WOMEN.

II.

Sweden.—Here we find the same danger threatening the domestic life of the people as in Belgium, although the causes to which this state of things is due are somewhat different.

For the last thirty or forty years the theory adopted by the educational authorities in Sweden has been that "the intellectual and the theoretical was that which was most useful for children; books became both the means and the end, and for a long time the children entertained the idea that they, having imbibed the wisdom of books, need not share in the daily work of the home. The youthful mind was full of mental pride; freedom of choice in their life's work was, and still is, the end of their endeavours; they wished to be able to compete with men in numerous branches of occupation, and for such posts book-knowledge alone was necessary, and therefore book-knowledge alone was studied." In illustration of this, it may be mentioned that during the last thirty years over six hundred young women have matriculated for entrance to the Swedish universities.

The Code of 1900 directed that, when possible, practical instruction in Domestic Economy should be given in Primary Schools, but so far it is only in Stockholm, Gothenburg, Malmö, and a few other places that the local authorities have been able to do so. This year, however, the Government propose to make a grant of £5000 for the teaching of domestic economy and cookery in the rural districts and villages.

In the towns named much has been done by the local authorities to further the teaching of domestic science, as may be seen from the following outline of the aims and method of teaching that obtain in most of the cookery schools in Sweden:—

"The aim of the cookery school is to impart to the girls an interest in, as well as a knowledge of, how to manage a home with wisdom, economy, and order; and at the same time to afford them a change in their sedentary school-work during school hours."

For this purpose the girls are allowed to perform all the various duties belonging to the kitchen, such as cooking, laying the cloth, serving, washing-up, scrubbing, sweeping and dusting, baking, laundry work, etc.

In every cookery school instruction is given to half a class at the same time, so that there are not more than about eighteen girls under instruction at once. The time devoted to the work in the cookery school is one day a week, usually from 10 A.M. to 3 P.M., and as a rule the girls take part in the ordinary school-work for an hour or two before going to the cookery school.

The girls are divided into groups, usually three in each group; each group has its own kitchen range and table, and its own cupboard with pans, crockery, and kitchen utensils. Each group cooks a dinner for six or ten children.

The instruction every day begins with a lesson on the menu, the quantity of materials, the wholesale and retail prices, how the food is to be prepared, its nutritious properties in relation to the cost, etc. Then follows immediately the practical part of the work, which the teacher superintends, to see that the instruction given is correctly put into practice. Each girl in the group has a number given her for the day, and all the girls who have the same number in the different groups have to perform similar work in the following order:—

No. 1 is to make a fire in the kitchen range and keep it up; she sees that there is water in the boiler, is responsible for the soup, cleans the kitchen stove and stew-pans, and is in charge of the household cupboard.

No. 2 prepares the first course, keeps the dresser clean, helps to lay the cloth and serve, scrubs the floor.

No. 3 bakes, cleans the rooms, lays the cloth and serves, dishes up the food, and splits sticks for making fires the next day.

Immediately after the lesson, or somewhat later during the course of the afternoon, some of the following subjects are treated: the kitchen; the kitchen range; making fires; sweeping and cleaning the kitchen range; ventilation of the kitchen; cleaning the dresser, the copper pans, enamelled pans, iron pots, tin pans, and wooden utensils; dishing up, putting the rooms in order, scrubbing; attending to the lamps; the laundry; food value of milk, eggs, meat, fish, vegetables, coffee, and tea; baking; the storage of meat and provisions; accounts and economy.

In Gothenburg a system has been adopted which enables a class of twenty-four girls to receive a course of instruction lasting thirty consecutive school days.

The subject is also being vigorously taken up in the Secondary Schools, for in addition to three Secondary Girls' Schools where the subject is treated theoretically only, and to four where it is taught to a continuation class, there are no less than twenty-two such schools where cookery is taught in accordance with the methods described when speaking of Primary Schools. There is, of course, a difference in the utensils used and the dishes prepared in the two classes of schools, there being

a greater variety in the number and quality of courses of the dinners cooked in Secondary Schools. Care is always taken, however, to restrict the cost of the meals prepared to the supposed incomes of those preparing them. The theoretical instruction, also, is more thorough in the Secondary Schools, being connected with the lessons in natural science, hygiene, and book-keeping; washing, ironing, and scullery work are given much more attention as well, these latter subjects having now triumphed over the short-lived opposition of a few parents. In most Secondary Schools the course lasts one year, with one lesson a week; but in some the course is two, and even three, years long, in which case the weekly lesson is shorter.

Needlework and dressmaking are classified as "slöjd," or, as it is known in England, "sloyd," a word meaning handiwork in general, whether it be that of men or women, and is more especially applied to work done in the home. The aim of the instruction in girls' sloyd is: "To exercise hand and eye; to quicken the power of thought; to strengthen love of order; to develop independence; to inspire respect for carefully and intelligently executed work; and, at the same time, to prepare girls for the execution of their domestic duties." The scheme includes knitting, plain needlework (underclothing and other garments), darning, mending, marking, tracing pattern designs, cutting out underclothing and other garments.

The instruction in needlework in Secondary Schools aims at giving the pupils technical skill in plain needlework, knitting, hemstitch, embroidery, patching, darning, marking, etc. The different kinds of stitches are introduced in series, increasing gradually in difficulty, and are applied to objects of plain work, such as aprons, chemises, petticoats, pillow-cases, etc. In some schools a course of plain dressmaking is also given. In addition to the Continuation Schools and Classes, in which the instruction in domestic subjects is similar to that given in the Primary Schools, there are two establishments in Sweden for giving practical instruction in the care of infants to women over eighteen years of age. The course lasts three months, and includes a series of theoretical lectures, eight or ten in number, given by a children's physician, treating of the hygiene, food, and illnesses of children. In practice, the pupils learn to wash and dress the babies, to prepare and give them their food, to attend to their wants in general, and to take them out for airings. During the last month of the course the students have the entire charge of one or two babies. The pupils live in the Home, and pay about 34s. per month for instruction, board and lodging.

Norway.—During the first decades after the year 1814, active efforts were made by the poet Henrik Wergeland and others to improve the education of the people. It was speedily recognised, however, that for a people living under such hard conditions as prevail in Norway, there is quite as much need of working hands as of working brains, in order to extract from the ungenerous soil and narrow surroundings that which is necessary for the maintenance of life; and if any progress was to be made, something must be done to instruct the young men in the principles of agriculture, and the young women in all kinds of domestic work. In 1865 the first true school of housekeeping was started by a private individual, and after a time received the support of the Society for the Welfare of Norway. In 1889 this society established two other schools, and afterwards entered into communication with the various provincial agricultural societies, and induced them to establish similar schools for their provinces, the Central Society defraying half the cost of erection. None of these schools receive direct support from the Government, but the Society for the Welfare of Norway receives a very large grant.

It was not until 1890 that any endeavour was made to teach household management in the Primary Schools, but now school-kitchens have been started in almost all Norwegian towns; although in some of the smaller towns the premises are unsuitable and often defective. The subject, however, is always optional, and is given out of school hours; the result being that the children from the poorest homes, who most need this sort of teaching, do not join, for even as children they have to contribute by their earnings towards the maintenance of the family. The plan of instruction, with a few local alterations, is uniform throughout the country. The demonstration lessons are given to two or three classes combined, *i.e.* 50 to 60 children, and last from 1 to 1½ hours. From 12 to 24 pupils—according to the size of the kitchen—take part in the practical work, and this number is divided into "families" of from three to six members. The practical lesson, which lasts three hours, consists of:—

(*a*) Preliminary work—*i.e.* clearing out the range and lighting the fire, fetching the articles of food, and putting out the utensils to be used.

(*b*) Going through the receipts, and apportioning the work for the day.

(*c*) Preparing and cooking the appointed dishes.

(*d*) Laying the table and dining (no charge is made for dinner).

(*e*) Washing up and cleaning the kitchen.

Each kitchen is divided into from three to five small kitchens, fitted up simply but completely, as befitting a working-man's or a mechanic's home, and the work is divided among the "families" in a manner similar to that which has already been explained in dealing with the schools of Sweden. In Christiania and many other towns the expenses of the school-kitchens are borne by the Municipality, aided by a Government grant as in the case of other public school teaching; but in places where the Municipality has not yet taken upon itself the expenses connected with this instruction, the work is supported by contributions from savings-banks, Government spirits monopoly, and by private benevolence.

Denmark.—Until quite recently the only domestic subject taught in the schools of Denmark was needlework; but quite lately the interest in domestic science has grown very rapidly, and although they are still behind many other countries in this respect, satisfactory progress is being made.

In 1897 three housewifery centres were opened almost simultaneously, and proved so successful that the interest spread rapidly among educationalists, parents, and authorities. The following year the Town Council of Copenhagen opened a few voluntary housewifery centres for girls, and these were so much appreciated by the parents that in 1900 the subject was made part of the curriculum for Standard VI. of all schools having access to a centre.

Continuation classes were also opened for girls from fourteen to twenty years of age. The first year the classes were attended by 132 girls, but in 1903 the number had risen to 603. The subject is also taught in ten Secondary Schools.

The methods of teaching housewifery in this country need not be detailed, for Denmark has adopted with slight variation the methods that obtain in Norway.

Switzerland.—At the present time great importance is attached in Switzerland to the teaching of domestic sciences; new schools and classes are continually being founded, and they are almost always quickly filled, so ready are the people to take advantage of the opportunities offered them.

The chief subjects included under the general head of Domestic Science are:—

Needlework, including mending, knitting, machine-sewing, drafting and cutting out; cookery, with lessons on the theory of nourishment; book-keeping; housewifery, *i.e.* general house-work and theoretical lessons on hygiene, cleaning, arrangement, etc.; laundry work, and gardening. Millinery is taught in some schools that give a business training. Some instruction on the proper feeding of children is often given in the theory and hygiene lessons, otherwise the care of the nursery and children has not yet found a place in domestic science curricula.

The different grades of schools in which domestic sciences are taught may be classified as follows:—

(1) Primary Schools; (2) Continuation Schools; (3) Trade Schools; (4) Housekeeping Schools proper; (5) Special courses in cooking, etc.

In the Primary Schools sewing is almost universally taught, and, with the exception of the Forest Cantons, it is everywhere compulsory. Great importance is attached to this subject, as the authorities insist that it has an educational as well as a practical value. Children do not join the sewing schools when they first enter the Primary School, but between their second and fourth school years they start on a systematic course which embraces all kinds of knitting, stitching, and mending, with some cutting-out, and occasional lessons in the use of a sewing-machine. The sewing schools may be held either in rooms specially arranged for the purpose, or in the ordinary classroom. Occasionally the pupils meet in the teacher's own house; but, wherever it is, the room must be fitted with a large blackboard, a cupboard with a lock for the work, and a frame for demonstrating the different stitches in knitting and sewing. Each Primary School class also forms a distinct class in the sewing school, but in country places, where the classes are very small, corresponding classes from different schools in the same district may be taught together. The number and distribution of the hours devoted weekly to needlework varies considerably; occasionally the subject occupies as little as two, or as much as eight, hours per week, but the usual time is from three to six hours.

It is still rather the exception than the rule to find domestic economy a compulsory subject in Primary Schools. Sometimes it forms part of the sewing course; in canton Baselland it is combined with science, and in Zug, Lucerne, Zürich, and other cantons it is taken as a special subject. In Zürich, one of the most advanced cantons, one hour a week is devoted to theoretical instruction, and the course there may be taken as an example of the plan followed wherever the subject is taught:—

1. Necessary qualities of a housewife (love of order, cleanliness, punctuality, economy).

2. The dwelling; its arrangement, how to keep the different rooms in order; cleaning, with reference to the healthy influence of a home.

3. Heating and lighting.

4. Clothing; general and hygienic observations; cleaning and washing.

5. Theory of nourishment; fundamental principles of a mixed diet; the chief articles of food, such as milk, eggs, meat, fish, green vegetables, potatoes, grains, pulse, luxuries, and spices, with accounts of their origin, varieties, food value, ingredients, purchase price, use, and preservation.

In addition to this theoretical domestic economy, all girls of the eighth Primary School class in Zürich town are obliged to learn cooking. As girls who are able to continue their schooling beyond the compulsory school age usually enter a Secondary School when they are about twelve, it follows that the eight-year pupils are generally the children of very poor parents, and it is just this class that the authorities are anxious to reach. There are three school-kitchens in Zürich, where the children receive a lesson of four hours once a week. The teacher begins with a very simple theory lesson, discusses the dish to be cooked and its value as food. After entering the recipe, with the exact cost, in their note-books, the children are divided into groups of three, four, or six, and their duties are apportioned. Each group works at a separate stove, and prepares the one or two dishes which form the subject of the day's lesson. As soon as the food is ready the tables are laid, and teacher and children take the meal together. Then everything is cleaned and put in order before the children go home.

As each canton and commune arranges the curriculum for its own schools, different conditions obtain in different parts. In some places, such as Bein, St. Gallen, and Basel, cookery is taught as an optional subject; but in spite of this there are, as a rule, too many applicants, and the classes are over full. Of all places where domestic economy is compulsory, the most complete course is to be found in canton Solothurn. The chief industry is watch-making, and the factories provide employment for girls and women as well as men; consequently the homes are altogether neglected, or left in charge of quite young girls. The authorities therefore decided to introduce domestic economy into the winter sewing lessons of the sixth and seventh school year, and made it compulsory for every girl to spend one whole day or two half-days weekly in a housewifery school, during the first year in which she is free from the Primary School.

The "Tochterfortbildungsschulen," or Continuation Schools, consist of various classes in technical and commercial subjects, which are held at any time of the day or evening, according to local convenience. They are controlled by the local educational authorities, and are open to all women and girls who have passed the Primary School age, but they are not compulsory. There are altogether about eighty of these schools, and the instruction is much appreciated. Each "Continuation School" must naturally be arranged to suit local needs, but the same principles underlie them all. Of town schools, the Zürich school-kitchen may be taken as an example. The pupils come straight from work at seven o'clock, and prepare their supper, which consists of tea, meat, and some inexpensive accompaniment, often a dish unknown in England. There are two lessons weekly for ten weeks; the pupils pay threepence each time for supper, and they are thoroughly in earnest and most eager to learn.

In the country districts the initiative has generally

been taken by one of the societies for promoting public weal; the president will visit one of the small villages, and after addressing the people on the importance of home life, will offer to provide a stove if the village will provide a suitable room. A teacher visits each village once or twice a week, and the village people are generally quick to recognise the value of the work.

The resident housekeeping schools of Switzerland are all private foundations, and most of them owe their existence to branches of the National Women's Society of Public Utility. The courses vary in length from three months to a year; and the fees for tuition and board, from 4s. to £2, 15s. per month. There are also a great many cooking courses, both public and private, varying in length, where the pupils attend daily from 8 A.M. to 2 P.M. Many of these courses are free, a small payment being made for dinner, and are largely attended by girls who are engaged to be married.

It will thus be seen that over a large part of Switzerland a thorough domestic training is in reach of every woman, and this fortunate region is constantly increasing in area as the value of the work becomes more apparent. The people have responded heartily, and it is a cheering sight to see the well-filled classes; one seldom hears of an empty place, and in many cases the pupils enter some weeks before the course begins. Thus there is every prospect that the teaching of the domestic sciences will expand and increase, for the attitude of the people, who fully recognise the importance of the subject, is of great assistance to both the teachers and the authorities.

THE NEW CODE.

THE Code of 1906 was very late in making its appearance, and the calm complacency with which it has been awaited and received contrasts strangely with the eagerness with which it was looked for twenty years ago. There are many reasons to account for this difference. In the first place, the work of the Board of Education has been greatly specialised—the Code of the present day affects only Public Elementary Schools within the narrowest limits. The Training Colleges have their own special publication, there are separate "Regulations" for the instruction and training of Pupil Teachers, and there is also a separate "Evening School Code." Besides all this, those important schedules setting out the work to be done by the different standards in the various class and specific subjects have been taken from the Code, and each school can draw up its own scheme of work. Then, again, the methods of paying grants, although still so complicated that Mr. Birrell has promised a Bill next year to codify them, are simplicity itself compared with the methods of twenty years ago. Then the desire to ascertain whether it would pay better to arrange the work so as to earn threepence on this subject or twopence on that did lead to a demand for early copies of the Code.

The regulations for inspection of schools contained in the present Code exceed the wildest dreams of the reformers who were agitating against the abuses of "Examination Day" twenty years ago. Some perhaps thought that the minimum of inspection had been reached when the Inspector was required to visit each school once a year, but now, under Article 50 of this Code, an Inspector can send in a report and recommend the payment of the grant without once coming near the school.

Of course, every school must be prepared to receive a visit from the Inspector at any time; but Article 21 distinctly states that "a school will not necessarily receive a formal visit of inspection or be made the subject of a detailed report by the Inspector each year, but every school will be so visited and reported upon from time to time."

As is explained in the prefatory memorandum, this change "will set the Inspectors free to take systematic measures for obtaining for themselves and for the Board a more thorough insight into and appreciation of the educational characteristics of the areas of the various Local Authorities, by conducting, over varying periods, careful and detailed investigations either into the work of certain selected schools within a district, or over a definite part of a Local Authority's area, or into the methods of teaching adopted in particular subjects or particular types of school, or into the different means that have been found efficacious in dealing with special urban or rural difficulties. They will thus be able to furnish to the Board comprehensive and instructive reports, sometimes of an individual and sometimes of a collective nature, upon particular groups of schools or upon particular parts of a district, or upon any special problems investigated, as may appear desirable in each case. The Board believe that, if they send to the Local Authorities from time to time the most valuable of any such reports, these may be found of greater use than the regular sending of the short and somewhat formal report upon *every* school *every* year. At the same time, owing to the diminution now rendered possible in the number of days taken up by formal inspections, the Inspectors will be able to pay occasional short visits to schools that are not formally inspected in a given period, and will thus not be prevented by their special investigations from keeping in touch with managers and teachers, from following changes in the teaching staff, or from giving special attention to schools of doubtful efficiency."

Teachers who have included instruction in "Special Subjects" in their curriculum have felt the strain and worry of the complicated clerical work involved in registering attendances and claiming grants on those subjects. A system of paying grants on groups of scholars instead of on individual pupils will do much to remedy this, and a prospective announcement is made that, in the year beginning 1st of August 1908, the number of scholars to whom demonstrations in any Domestic Subject may be given will be reduced to the number who are at present allowed to undertake practical work at any one time and under any one teacher in those subjects. The principal reason for this change is, that the present arrangement leads inevitably to a divorce between demonstration and practical work, which is educationally unsound.

The Board is anxious to increase the proportion of trained teachers employed in the schools, and a footnote to Article 10 says: "After 31st July 1909, the Board may require by the Code the employment upon the staffs of Public Elementary Schools, subject to existing appointments, of a certain proportion of Certificated Teachers who have completed a course of training in a Training College."

It was always understood that the minimum qualification of those ladies over eighteen, who were known as Article 68's, was that they should have been "suc

cessfully vaccinated." Vaccination also appeared among the necessary qualifications of every other grade of teachers; but now "it has been represented to the Board that, in view of recent legislation with regard to vaccination, there is a hardship in the continuance of their long-standing requirement that every teacher or pupil teacher employed in a Public Elementary School shall have been duly vaccinated. While the Board feel that it is not unreasonable to take greater precautions against infection where a number of children are brought together within the limited space of a school-room than might be necessary in other circumstances, they are prepared to leave the responsibility of this matter to the Local Education Authorities by whom the teachers are employed. They have, therefore, inserted a provision in the Code relaxing the obligation to be vaccinated in the case of teachers who have declared themselves to have a conscientious objection to vaccination. A similar provision has been inserted in the Regulations for the Instruction and Training of Pupil Teachers. The fact that such a teacher has been unvaccinated will in all cases be kept on record by the Board; and it must be clearly understood that the Board will not recognise any such teacher in any school except with the consent of the Local Education Authority, whose duty it will therefore become to satisfy themselves that the precaution of vaccination may be dispensed with without risk to the children with whom the unvaccinated teacher may be brought into contact."

The Code now provides that suitable organised games, such as cricket, football, hockey, and rounders for boys, and similar appropriate games for girls, may, under certain conditions and under competent instruction, be played during the hours set aside for an afternoon attendance, thereby counting, within proper limits, as a part of the school routine.

The beneficial interchange of mental and physical activities now obtainable in a good Infants' School will thus have its counterpart in the schools for older scholars, on a system which has done much to build up the physique and mould the character of the boys and girls in our Secondary Schools.

Hitherto participation in organised games has been made possible for elementary school children only by the voluntary efforts of head and class teachers, *outside of school hours*. The sacrifice of their spare time, which those teachers have spontaneously made, has been rewarded by an improvement in the health and *esprit de corps* of their scholars, so marked as to afford every hope that a national advance in these respects will follow the inclusion of organised games in the school curriculum.

The lessons to be learned in the playground are indeed invaluable. Children who take part in properly organised games will learn, among other things, to "play the game," to "give and take," to devote themselves to, and efface themselves for, a common cause, to feel pride in the achievements of others, to accept victory with becoming modesty and defeat with due composure, and, speaking generally, to acquire the spirit of discipline, of corporate life, and of fair-play.

The only other change of importance in the Code is the definite inclusion of Moral Instruction as a subject that should be universally adopted. The Second Article of the Code, which sets out the "Curriculum for Scholars other than Infants," concludes with the words:—

"*Moral Instruction* should form an important part of every elementary school curriculum. Such instruction may either (i.) be incidental, occasional, and given as fitting opportunity arises in the ordinary routine of lessons, or (ii.) be given systematically and as a course of graduated instruction.

"The subject of this instruction, whether given by the methods indicated in (i.) or in (ii.) above, should be on such points as courage; truthfulness; cleanliness of mind, body, and speech; the love of fair-play; gentleness to the weaker; humanity to animals; temperance, self-denial, love of one's country, and respect for beauty in nature and in art.

"The teaching should be brought home to the children by reference to their actual surroundings in town or country, and should be illustrated as vividly as possible by stories, poems, quotations, proverbs, and examples drawn from history and biography.

"The object of such instruction being the formation of character and habits of life and thought, an appeal should be made to the feelings and the personalities of the children. Unless the natural moral responsiveness of the child is stirred, no moral instruction is likely to be fruitful."

THE GOLD OF SICILY.

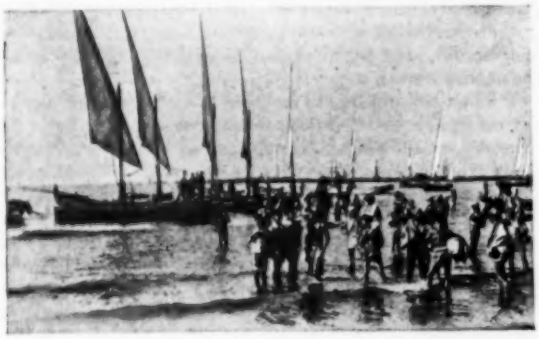
WITH the summer vacation looming in the distance, and plans to be made as to how it shall be spent, to the hard-worked teacher I would most emphatically say, leave England with all its too common seaside resorts, and seek "fresh woods and pastures new." Not only will the actual enjoyment be great at the time at the new sights, sounds, and experiences of the rapidly flying days, but for years afterwards there will be pleasant memories to recall of your trip to Spain or France, or even further afield. Then, may be, your experience will be similar to my own but recently, when, comfortably ensconced in our rooms after a heavy day, we were casting about for something to amuse us during the evening—should it be novel, or pipe, or friendly club? Scanning the familiar bookshelves, our eye is caught at last by the red edges of a particularly bulky note-book, a much-treasured record of travel in distant lands.

The problem is solved, and with a smile of content we settle down to review the scenes of a journey in far sunnier climes but recently completed. With the fingering of its pages our surroundings are entirely forgotten, and we revel in turn in the gaieties of Cairo, the warmth and colour of Tangier, the wonders of Naples, and the beauties of Palermo; and on and on as in a kaleidoscope the scenes flit before us. We reach for a match to rekindle the neglected pipe, and like a flash the idea of sulphur suggests the home of sulphur—Empedocle the Ancient, in distant Sicily—and in the glowing fire the panorama again unfolds itself.

The trim little yacht is slowly swinging at anchor off Il Molo, with the old Porto nestling at the foot of Mons Camicus, that looks out over leagues of the bluest water in the world to Tripoli on the far distant African shore. We row lazily ashore and present ourselves before the captain of the port, a sleek, olive-complexioned official with an ultra-urbane manner and expressive hands. The quay on which we stand is battered and weather

beaten by the ceaseless lap of the tideless Mediterranean, and as yellow as a guinea, with a thick layer of sulphur dust that covers everything like a mantle of coloured snow.

The necessary formalities over, we are left the unconcerned objects of a crowd of *lazzaroni* who have collected as if by magic for a sight of the *stranieri*. They are unemployed, and yet not unemployed; for though they



EMPEDOCLE.

never have worked and never will, yet a few olives and bread, with the inevitable glass of wine, will amply suffice them from day to day. And then how easily the day passes with them, curled up in the sunniest nooks asleep, or else gaming with knucklestones for imaginary coins. A few soldi, however, thrown indiscriminately amongst them, rids us of their doleful chant, "Muore di fame, signori," and we saunter along the beach to examine more closely the "gold of Sicily."

Piled high along the shores of the bay for half a mile or so we encounter sulphur in every conceivable shape and condition, in blocks and rolls and powder, in bags and barrels, or loose in great heaps like sandhills. It is brought here by the hundreds of tons from the mines inland, and is waiting to be carried out, when the sea is favourable, by scantily clad, ghastly-looking labourers wading knee-deep in the sea to swift-sailing feluccas that beat out to the end of Il Molo, and then tack back into the harbour, where the hungry holds of the cargo steamers await them.

A trip in one of these sulphur-boats, manned by picturesque-looking sailors, is an experience at once novel, exciting, and finally painful. For a lire or so the boatmen will allow the stranger Inglesi to watch the sulphur being stowed in the brown-sailed barquetta and then to sail out with them over the bay. With hoarse cries and almost demoniacal gestures they clear the shore, and then crowding on all sail rush through the water, bows under all the time, and heeling over at a fearful angle, until they reach the quiet water inside the breakwater.

But the sulphur makes itself felt, and that unpleasantly, almost before the gleaming yellow bulwark on shore has been left well behind. A sharp tingling sensation in the eyes is followed by copious floods of tears, which in no way relieves the trouble; and so the stranger presents the curious spectacle of a smiling face and streaming eyes, which never fails to affect the risible faculties of the sailors. However, a speedy return to one's cabin, and the liberal application of vinegar and water, soon allays the intolerable irritation. Although those engaged in the trade assert that they get quite used to it, the hardening process must certainly be long and painful.

Having seen and felt enough of the useful commodity for the time being, we conceive the idea of exploring the ruins of Girgenti (the ancient Akragas), which towers at the summit of Camicus, overlooking the port below. In driving up the hill behind a diminutive Sicilian pony, one is struck with the vast dimensions the city had in Grecian days. All the vine-clad slopes between Mons Camicus and La Rupe Atenea are strewn with the ruins of its former greatness. Here one finds the most notable collection of ancient temples in the world, excelling anything similar to be found even in Greece itself. Six ruined temples stand here side by side, the wonder and admiration of all who behold them, situated in the midst of the most beautiful scenery, with their fallen shattered columns tenderly bound up by variegated greenery and wild flowering plants.

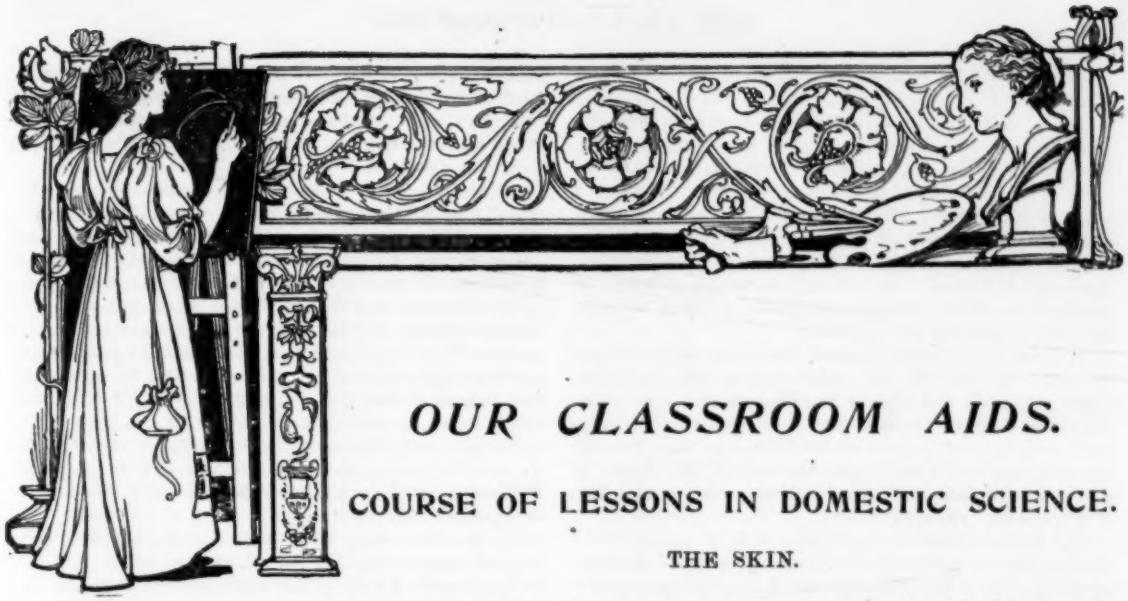
All that marks the temples of Juno and Hercules now, however, is a confused mass of huge fallen rocks; the Temple of Concord, which we find in better condition, was curiously enough transformed for a time into a Christian church. Not satiated yet, we wander through the Temple of Jupiter, unique in that it is the largest temple ever erected by the Greeks to any of their gods. Away to the westward stands the Temple of Castor and Pollux, the most picturesque of them all, with its columns adorned by coloured pigments that have withstood the ravages of time and warring elements, and serve to show us that the ancients sometimes painted the outside of their temples, as they did the inside, with the most gaudy colours. Finally, in a ravine below, surrounded by olive and almond trees, we linger before the columns of the Temple of Vulcan,

GIRGENTI.

still upright, though covered with creepers, which veil their decay and give softness to their outlines.

And then the mind strikes off at a tangent, and we muse upon bygone dynasties, upon Greek and Roman conquerors, and the days when those temples stood erect in all their glory, and white-robed priests made sacrifice upon those high stone altars, till the falling in of the dying fire and the steady pattering of the rain outside recall us to the stern realities of the present day.

Tuition by Correspondence.—In spite of the increased educational facilities that have been opened up during the last few years, there still remain a large number of students who are required to pass examinations for which they can obtain no oral instruction. The phenomenal results obtained by the Normal Correspondence College in the last King's Scholarship examination proves the excellence of the help they can obtain by post.



OUR CLASSROOM AIDS.

COURSE OF LESSONS IN DOMESTIC SCIENCE.

THE SKIN.

Step I. Preparation.—Since soap is such an important factor in maintaining personal cleanliness, one lesson should be devoted to its properties and preparation.

Water and oil will not mix together, as may be shown by pouring a little of each into a test tube and shaking them together. At first a whitish emulsion is obtained, but after the mixture is allowed to stand for a little while the oil will separate from the water, and form a distinct layer on the top. Before oil or fat can be dissolved in water it must be acted upon by an alkali, such as potash or soda, which decomposes it, glycerine being set free, while the alkali combines with the fatty acid to form soap.

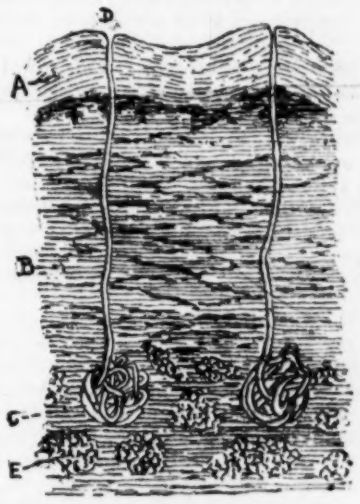
Place some lard in an evaporating dish, add an equal quantity of strong solution of caustic soda, and warm gently. At first the fat will float on top, but gradually it will disappear; if it should not do so, more alkali must be added. When the fat has entirely disappeared, add an equal quantity of hot salt and water; a curd will rise to the top, which will harden on cooling, giving a cake of soap, while the liquid underneath will contain the glycerine. If potash is used instead of soda, the soap will not set into a hard cake, but will form soft soap.

From this demonstration of the method of preparing soap, it is evident that great discretion must be used in adding the alkali, for, as a given amount of fat can only combine with a definite amount of alkali, it is evident that if too much of the latter is added the excess will remain in the soap as free alkali. All soap must contain a slight excess of alkali, but cheap soaps, which have been hastily and carelessly prepared, often contain a very large amount, and on that account are exceedingly irritating to the skin.

Step II. Presentation.—The skin consists of two parts: (1) the dermis, or true skin; (2) the epidermis, or outer layer.

The Dermis.—This consists of a vast number of tiny cells, and is full of nerves and blood-vessels; how closely these nerves and blood-vessels lie together is shown by the fact that the point of a needle cannot be inserted anywhere into the dermis without causing pain and drawing blood. It is obvious, therefore, that if this formed the outermost covering of the body we should live in constant agony, but the tiny cells that form the dermis are renewed from below, and gradually pass upwards. As they approach the surface, however, they become flattened and granular, until at last they are converted into flat, horny scales.

The Epidermis.—This is composed entirely of these horny scales, and being entirely without nerves or



A. Epidermis. B. Dermis.
C. Sweat Glands. D. Sweat Pores.
E. Fat Cells.

blood-vessels it serves as a protection to the extremely sensitive dermis beneath; in this way the sense of touch is preserved to a greater or lesser degree in every part of the skin, but nowhere are the nerves exposed. The epidermis is fed from below by the dermis, and as the cells reach the surface they become dry and hard, and are cast off in flakes or scales, forming the well-known "scurf." The most cursory examination of the skin on the fingers and palms of the hands will show the presence of a vast number of sinuous ridges; these mark the presence in the dermis of tiny elevations, each containing the ends of

minute nerves, by means of which we possess the sense of touch.

The Glands.—A magnifying glass will show the presence of a number of minute pores in the epidermis; these are the mouths of tiny glands, the lower ends of which are situated among the blood-vessels of the dermis. These glands are of two kinds: (1) *fat-glands*, which secrete an oily substance which keeps the hair and skin supple and soft; (2) *sweat-glands*, which pour out moisture that serves the double purpose of removing certain waste products, and helping to regulate the temperature of the body.

The Nails.—In certain parts the horny cells, instead of being thrown off, are built up into definite structures; thus, at the tips of the fingers and toes these cells are matted together into a solid plate forming a nail which, being renewed from below and behind, slides along in its bed until the end of the finger is reached, after which it would probably soon get broken if it were not trimmed off.

The Hair.—Like the nails, the hair is composed of horny cells similar to those of the epidermis. Each is embedded in a kind of bag called the hair-sac, at the bottom of which is a minute prominence which gives off the horny cells that go to build up the hair.

Step III. Association.—The skin has several functions, and it is necessary for the proper maintenance of health that these should be discharged effectively; but as we shall now see, this cannot be done unless the skin is kept scrupulously clean, for the dead scales, oil, dirt, etc., which would otherwise accumulate will impede the healthy action of the skin in the following ways:—

1. *By blocking the sweat-pores.*—This interferes with the elimination of certain waste products that should be thrown off in the sweat. If, however, the pores are choked with dirt, these waste products are reabsorbed by the blood, and the task of expelling them from the system devolves on the lungs and kidneys, thus throwing extra work on these organs, and destroying the proper balance of the system. Further, as the sweat cannot be poured out on to the skin, we lose one of the agents for regulating the temperature of the body.

2. *By blocking the fat-glands.*—A dirty skin soon becomes dry and liable to crack, as it is deprived of the natural oil that should keep it soft and supple. The accumulation of oil and dirt in the pores sometimes causes inflammation in the surrounding parts, giving rise to pimples, and often permanently injuring the skin.

3. *By lessening the sensibility of the skin.*—When covered with dirt the skin will not respond so readily to alterations of external temperature, and thus the susceptibility of the person to chills and colds is greatly increased.

4. *By favouring disease.*—Many diseases of the skin are caused by parasitic growths, and nothing affords a better breeding-ground for these than a dirty skin. Unfortunately these parasites do not always remain in their breeding-ground, and as the conditions of modern life bring us into contact with all kinds of people, a few words should be given on the nature and treatment of these diseases if occasion require.

Ringworm is due to the growth of a vegetable fungus which may attack the skin on any part of the body. Should it attack the scalp it will require long and patient treatment to get at the root of the evil, but in other parts it can easily be checked by treating the part with iodine or carbolic acid. Cleanliness is most essential to the treatment, and extreme care should be taken that the spores are not conveyed to other children by towels, etc.

Scabies or *itch* is caused by a minute animal parasite. The female burrows into the skin, and deposits about a dozen eggs; in less than a fortnight these are hatched, and the young ones immediately commence burrowing on their own account. This is a troublesome complaint, and one that it is difficult to get rid of, as simple washing will not remove the intruders; the best method of getting rid of this parasite is by bathing the parts repeatedly in hot water in order to soften the skin, which should then be rubbed briskly with a hard, rough towel in order to remove the upper part of the epidermis, and lay bare the burrows, thus preparing the way for some parasiticide such as sulphur ointment. This treatment should be continued until the trouble is removed.

There are several other animal parasites which are too well known to need enumerating; these can only be kept under by strict attention to cleanliness, both in the person and the home.

Step IV. Formulation.

1. Soap is formed by the action of an alkali on a fat.

   Alkali + Fat = Soap + Glycerine.

2. The skin consists of two parts:—
   (*a*) The dermis or true skin, full of nerves and blood-vessels.
   (*b*) The epidermis, no nerves or blood-vessels; grows from below, and sheds the upper horny cells.
3. Two kinds of glands in the skin:—
   (*a*) Oil-glands, which secrete an oily substance that keeps the hair and skin soft.
   (*b*) Sweat-glands, which secrete moisture which carries off waste matter and regulates temperature.
4. A dirty skin is injurious to health, because—
   (1.) The pores are choked, and the glands cannot act.
   (2.) It is less sensitive to changes of temperature.
   (3.) It forms a good breeding-ground for germs and parasites.

Step V. Application.—Having seen the need of personal cleanliness, the last step is to show how it may best be maintained.

Washing.—On account of the oily secretion of the skin, water alone cannot cleanse the skin properly without the addition of soap. The alkali in the soap combines with the oil, forming an emulsion which is easily removed by the water, and carries away with it the dirt which has collected on the skin and in the pores. There is no substitute for soap which will do the work half so effectively, the various toilet preparations that are placed on the market being of little use in removing obstructions from the pores and crevices of the skin. Good soap should not irritate the skin, but if any slight irritation is experienced it may be allayed by adding a little sal-volatile or lemon-juice to the water.

Bathing.—Although the primary object of bathing is cleanliness, it also acts as a tonic, and when combined with swimming forms a healthy exercise. The warm bath is most efficient for purposes of cleanliness, and even when a cold bath is taken every morning, an

occasional warm bath with a free use of soap is necessary to remove the oily secretions. Great care should be exercised in taking warm baths, as they relax the blood-vessels of the skin; on this account they should not be taken more often than once a week, and then only at night before going to bed, or if taken at any other time the body should be sponged immediately after with cold water to avoid taking cold. A cold bath should be taken if possible every morning by all persons in robust health, as it acts as a tonic to the skin, strengthening the nerves, and making them respond more readily to changes of temperature, thus diminishing the tendency to "catch cold." Those who cannot take a cold bath without experiencing cold and chilliness afterwards should add just sufficient hot water to prevent this feeling, without making the water warm enough to spoil the after-glow caused by the blood returning to the skin.

The Hair and Nails.—These require great attention; the hair should be thoroughly well brushed in order to remove the scurf, but soap should be used very sparingly, as it acts on the oily secretions, thus making the hair dry and brittle; the nails should be cut square across, and of course kept scrupulously clean.

"WHAT MEAN THESE STONES?"

THE STUDY OF ARCHITECTURE IN ITS RELATION TO HISTORY.

BY EDMUND A. GREENING LAMBORN,
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Introduction.

THE purpose of the following series of articles is to reveal to such as have not yet considered the subject the wealth of interest which is to be found in the study of the parish churches in this country. Just as the present enthusiasm for Nature study has revealed to the people at large the wonderful lore which lies, hitherto unregarded except by the few, before their eyes, so, close at hand in the village churches, lies open a book of almost equal interest and charm, which a very little knowledge will enable a careful observer to read and understand. And indeed the grey pages of this latter book have this advantage over the green ones of Nature's, that they speak of things of *human* interest, "of famous men and our fathers that begat us."

One of the gravest charges brought against elementary education in the past is that it has unfitted many of the lower classes for the work and circumstances of their life by stimulating desires for mental interests, in seeking to gratify which they have been drawn to the social life and public places of amusement of the towns, usually to their own detriment and to that of agriculture—the country's vital industry. It is certain that the true aim of education is to fit the individual to the circumstances and state of life to which it pleases his Maker to call him, rather than the reverse, and therefore one of the great educational problems of to-day is how to develop in primary school children, especially in rural districts, a capacity for simple and healthy mental pleasures apart from the artificial enjoyments purchaseable in the towns. Nature study has solved the same problem in the case of many a rural parson, and Nature study, I believe, will be a great factor in doing the same for the next generation of rural population. Lead the rural Peter Bell to see something more than "a yellow flower" in the "primrose by the river's brim," help him to gain some insight into the beauty and the mystery and the wonder of his surroundings, the freshness of which to the seeing eye not age can wither, nor custom stale the infinite variety, nor the study of a lifetime exhaust the wealth of interest, and having opened his eyes to the pleasures and compensations of a life of which his fathers only saw the hardships, much will have been done to solve the problems of rural depopulation and the related one of physical deterioration.

To indicate to teachers, and through them to country children, another source of quiet interest and pleasure, to be enjoyed by all without money, and without other price than a little trouble, in the study of the architecture and history of the churches of the countryside, is the reason these papers have been written.

An Outline History of Architecture.

"The history of Architecture," says J. H. Parker, "is the history of civilisation written on stone, in a language easily learned, and which cannot deceive. Every nation has an architecture of its own just as distinct as its language." Thus the origin of architecture springs from the first necessity of civilisation, the necessity of roofing over a space between walls or pillars. Now there are three ways, and only three, in which this may be done:—

1. By bridging over the space with a long stone—the Architecture of the Lintel.
2. By covering it by a Round Arch.
3. By roofing it over by stones, straight or curved, inclined to one another at an angle—the Architecture of the Gable.

There are three great architectures of the world which correspond respectively to these three ways of effecting the essential function of architecture—that of roofing a space. All national systems are but varieties of one or another of these three great types.

The Architecture of the Lintel is the most obvious and so the most primitive. It is also, both from the point of view of strength and beauty, the worst of the three. This is the architecture of the oldest peoples, of Egypt, of Assyria, and of Greece. It is illustrated in its simplest form by Stonehenge and the other prehistoric cromlechs of England and Brittany, and in its complete development by the Parthenon and the temples of Greece. The Romans copied this architectural system from the Greeks, but also evolved—

The Architecture of the Round Arch, which, after the fall of the Roman Empire, was developed by the Teutonic peoples, to whom Rome bequeathed her civilisation, into what is known as the Romanesque style, and by the Eastern peoples into the style known as Byzantine. In England, the ruder stages of the Romanesque style are illustrated by Saxon and Early Norman architecture, and its full development is seen in the late Norman buildings of the reign of Henry II.

From the Romanesque style of architecture was

evolved by the Teutonic peoples, towards the end of the twelfth century, the last and greatest system—**The Architecture of the Pointed Arch or Gable**, known now

FIG. 1.

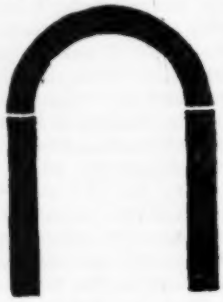

FIG. 2.

FIG. 3.

as the Gothic Style. This is the national architecture of the English people. In England the first stages of its development, known as the Early English style (1180–

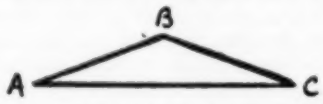

FIG. 4.—The Classical roof and roof-mask. AC is the flat roof or roof proper; AB, BC form the roof-mask; ABC is the pediment.

FIG. 5.—The typical Gothic roof and roof-mask. AD, DC form the roof proper; AB, BC the roof-mask.

1280), its period of matured perfection in the Decorated or Perfect Gothic Style (1280–1380), and its gradual deterioration through the stages of the Perpendicular Style (1380–1500), occupied the three centuries (1200–1500), corresponding to the period when the constituent elements of the English race were being fused and welded into the English nation.

Towards the end of the fifteenth century, the conquest of Constantinople by the Turks resulted in the dispersal over the west of Europe of the classical manuscripts in the possession of the scholars there, and the consequent revival of classical literature was accompanied by a revival of pagan art. Therefore in Western Europe the Gothic style of architecture was superseded by an imperfect imitation of the Roman or

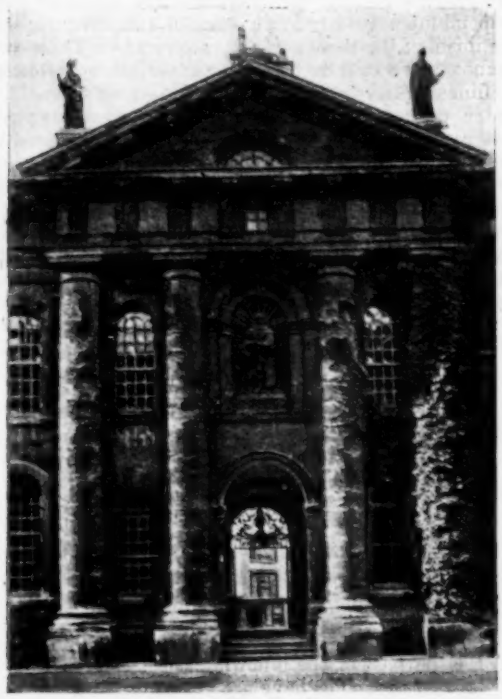

FIG. 6.—The Clarendon Building, Oxford, A.D. 1713. A Renaissance building illustrating the features of the Doric Order.

Grecian styles. This period is, of course, known as the Renaissance, and the revived Classic style of building, which was practically universal until the middle of the nineteenth century, is called "the Renaissance Style."

Since 1850, though the Classic style is still the model for many public buildings—witness the new Central Criminal Court now nearing completion—there has been a gradual revival of the Gothic style in ecclesiastical and domestic architecture.

CLASSICAL ARCHITECTURE.

Its Outward, Visible Signs.

As the later styles of architecture are ultimately traceable to the architectural systems of Greece and Rome, and as the buildings of those countries were revived as models in the sixteenth and two following centuries, during which many of our English churches, great houses, public halls, and, especially, chapels were built, it will be well to mention here some of the most easily distinguishable characteristics of the Classic style.

As has been said, the Classic style is the architec-

ture of the lintel, and hence it is an architecture in which the *horizontal line is dominant.* It is the architecture of flat roofs and spacious areas, as the Gothic style is the architecture of spires and pinnacles and lofty height. Now, to protect the flat roof from the weather it was necessary to cover it with a "roof-mask," or outer roof, from which the rain would run off. The roof-mask consisted of a wide, low gable, in which the upper angle was *obtuse.* Such a gable, as distinguished from the high Gothic one in which all the angles are *acute,* is called a Pediment, and the flat roof with the pediment forms the first great distinguishing mark of buildings of the Classic style.

Doorways and windows in Classic buildings are either lintelled, *i.e.* square-headed, as in the Greek type, or round-arched. As the Renaissance architects usually copied Roman buildings, there are many round-headed windows in English buildings of the Classic style. They generally have the key-stones in the heads projecting beyond the surface of the wall. Sometimes the quoins (*i.e.* the corner-stones) of the jambs and lintels are "rusticated." Occasionally an ornamental pediment is placed above the lintel, also projecting from the surface of the wall. The photograph of Clarendon Building, Oxford, shows two window arches with projecting key-stones, and illustrations of "rustic work" are given in Fig. 17.

Another distinguishing characteristic of buildings in the Classic style is to be found in the columns which support the roof, or ornament the front of a building, or support the flat-roofed porch (or portico) with open sides which often protects the main entrance of a building. Of these pillars there are five kinds or "Orders," the structure, proportions, and ornamentations of which were fixed by arbitrary laws. Three of these orders were invented and used by the Greeks—the Doric, Ionic, and Corinthian orders, and the Romans used in addition two others, the Tuscan and Composite orders, which they produced in the one case by modifying the Greek Doric, and in the other by combining the features of the Ionic and Corinthian into one order.

FIG. 7.—The Portico of the Ashmolean Museum, a modern building of the Ionic Order.

FIG. 8.—The Gateway of the University Press, illustrating the Corinthian Order.

Photographs of English copies of the Doric, Ionic, and Corinthian Orders are shown, and in them may be noticed :—

The triglyphs, metopes, and guttæ which distinguish the Doric Order.

The large volutes, the echinus or egg and dart ornament, and the dentils which ornament the Ionic Order.

The Acanthus Capital, with its three rows of acanthus leaves, which is the most striking feature of the Corinthian Order.

The last means of which I will treat of distinguishing Classic buildings is by their ornamentation. All the details of Greek and Roman architectural ornament were fixed, like the structural proportions, by arbitrary laws, the capitals in each order are all alike, the mouldings unvaried, for each ornament there is one precise symmetrical shape to which all conform. (Figs. 9, 10, 11, 12, 13, 14, 15, 16, 17.) The most common Classical enrichments are shown in the drawings. It will be seen that they are all such as may be executed with absolute precision by line and rule. Their execution is a purely mechanical matter involving only manual skill, but that of faultless kind. The workman has not to design, but to copy and repeat.

We will now proceed to consider the inferences which follow from the observation of these outward characteristics of the Classic styles.

Classical Architecture.

Its Inward, Spiritual Meanings.

As a nation, like an individual, may be judged by its works, and as a nation's architecture is the result of the nation's needs, let us examine how far the architecture of Greece and Rome is an index of the national

Fig. 9.—The Echinus, the Egg and Dart, Egg and Anchor, or Egg and Tongue ornament used in several of the Classic Orders and very common in Renaissance and modern Classical work.

character of those peoples. It has been said that, as the dominant line in Classical architecture was the horizontal one, the buildings were characterised by spacious breadth, as the Gothic ones are by lofty space.

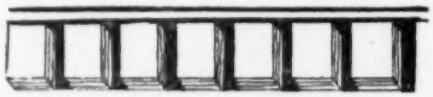

Fig. 10.—Dentils (little teeth) almost as common a Classical ornament as the above. (See Figs. 7 and 8.)

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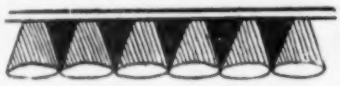

Fig. 11.—Guttæ (drops), small ornaments like drops used in the Doric Order beneath the triglyphs. (See Fig. 6.)

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Fig. 12.—Guilloche, a flat ornamentation used in Classic architecture as a horizontal border.

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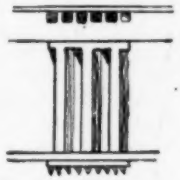

Fig. 15.—The Triglyph which distinguishes the Tuscan and Doric Orders. The spaces between the triglyphs are called Metopes and the projecting blocks above them Mutules. (See Fig. 6.)

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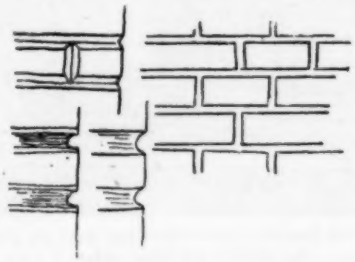

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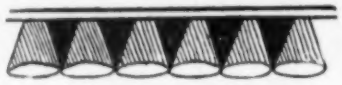

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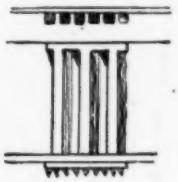

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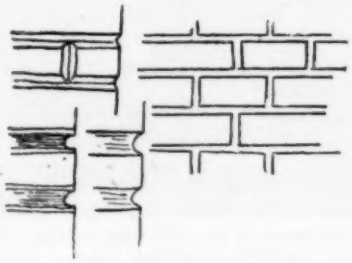

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fact being that the figure sculpture, which evidences that power in the highest degree, was executed by an *artist*, the stereotyped details by a *mechanic*. In short, the details of architecture among the ancients were a *manufacture* and not an *art*. Now manufactures, producing articles which conform to fixed rules and measurements, and match precisely each the other, imply *machines* rather than men; and now the reader will see the connection between this fact and the character of the builders, when he remembers that in pre-Christian times the *workmen were slaves*. The faultless precision of the details of Greek ornament implies the complete subordination of the thinking power of the workman to mere manual dexterity,—the workman was but the *tool* for the execution of another's *thought*. Upon the parallel which may be drawn between this stultifying of the higher faculties of the workman in the slave states of old and the increasing specialisation in English manufactures to-day, Ruskin has spoken. I will only point to the significance of the term commonly used to designate a twentieth century operative—he is a "hand."

Later, we shall see that the noblest attribute of Gothic or Christian architecture was that it freely recognised the equality of all men in the sight of God—not attempting to degrade the workman to the level of a carving-machine; and in its beauties and imperfections alike we may find the evidence of the fact.

TEACHING NOTES ON "THE NINETEENTH CENTURY."

By the Author of "Practical School Method Notes," etc.

I. Introduction.

AT the present time there is a tendency for special periods in History to be taken in the upper standards. This is a move in the right direction—a move that has been encouraged in the "Suggestions." The only difficulty connected with this idea is the selection of a suitable period, as there are several periods of almost equal importance. After a careful consideration of the merits of the respective periods, the selection of the "Nineteenth Century" has much to commend it.

In the first place, it is far better for a boy to have some knowledge of recent, or modern, events than of those more remote. Secondly, a knowledge of modern history is necessary in order to understand the newspapers and current events. Thirdly, modern events appeal with greater force to a boy of twelve or thirteen than, say, the Feudal System, or the Wars of the Roses, or the events in the reign of Charles II. Fourthly, the events of the nineteenth century are exceedingly interesting; for during this epoch we have the marvellous inventions and wonderful discoveries which give us so much comfort, luxury, and happiness at the present day; some of the finest literature the world has ever produced has been written; we meet with some of the greatest men that have ever lived; and we see the great industrial awakening that was destined to convert England from an agricultural country into a manufacturing and commercial country, second to none. And, fifthly, the nineteenth century may be regarded as the greatest and most wonderful of all centuries.

In the next section we append an outline scheme of lessons.

II. Outline Scheme of Lessons.

THE NINETEENTH CENTURY.

1. *The Chief Events of the Eighteenth Century bearing on the Nineteenth Century.*

(*a.*) The Seven Years' War and its Results.
(*b.*) Walpole and his Policy.
(*c.*) Life of William Pitt.
(*d.*) French Revolution and its Effects.
(*e.*) Industrial Development.

2. *The Condition of England in* 1801.

Condition of the Working People. Effects of the Introduction of Machinery. Punishments. Coarseness of Public and Private Life. Amusements, etc.

3. *Parliamentary Affairs.*

(*a.*) Parliamentary Reform and Catholic Emancipation (1820–30).
(*b.*) The Reform Bill and its Consequences.
(*c.*) Sir Robert Peel and Free Trade.
(*d.*) Mr. Gladstone and his Premiership.
(*e.*) Lord Salisbury, etc.

4. *Naval and Military History (including Colonial Expansion).*

(*a.*) Napoleon: His Victories and Defeat.
(*b.*) The Life of Nelson.
(*c.*) The Peninsular War (1808–1815).
(*d.*) The Duke of Wellington.
(*e.*) The Indian Mutiny.
(*f.*) The Crimean War.
(*g.*) Minor Wars, *e.g.* Afghan War, First Boer War, the Reconquest of the Sudan, etc.
(*h.*) The South African War.

5. *The Writers of the Century.*

(*a.*) Thackeray and his Works.
(*b.*) Dickens and his Influence.
(*c.*) Huxley, Darwin, and Tyndall, three great scientists.
(*d.*) The Historians of the Century.
(*e.*) Sir Walter Scott, the great novelist.
(*f.*) Tennyson and his Poems.
(*g.*) Progress made in Literature during the Century.

6. *Economic and Social Improvements.*

(*a.*) Factory Legislation.
(*b.*) Brief History of Education in the Nineteenth Century.
(*c.*) The Penny Post.
(*d.*) The Abolition of Slavery.
(*e.*) The Great Exhibition (1851).
(*f.*) Social Reforms.

7. *Discoveries and Inventions.*

(*a.*) Discoveries in Science.
(*b.*) Geographical Discoveries.
(*c.*) The Age of Steam (1800–1850).
(*d.*) The Age of Electricity (1850—present day).

[For further details of (*c.*) and (*d.*) refer to article "Teaching Notes on Our Trade and Commerce," in the March issue of the *Practical Teacher*.]

8. *Modes of Transit.*

Railways. Ocean Liners, etc.

III. Suggestions and Hints.

In the above scheme it will be noticed that the events have been grouped under certain headings. For some years we have taught history on this plan, and from experience can say that it possesses many advantages over the chronological method. By this system the continuity of events is maintained, and the true relation shown between cause and effect. Special attention, too, has been paid to the victories of peace, such important subjects as discoveries, inventions, educational progress, social improvements, etc., receiving the attention they deserve.

The scheme has been drawn up for Standard VII. It may be adopted in Standard VI. if few boys stay through Standard VII.

Wherever possible, the biographical treatment should be adopted. Biography is, as a rule, a favourite subject with children. A good teacher can make his characters actually live again, and it is this that is required in the teaching of history more than anything else. Weave the events round a notable personage, and present a *living* character to the scholars. At this stage boys and girls are intelligent enough to appreciate "motives," and these should be brought out, and at the same time the consequences of a certain line of action should be noted. Give only the outlines—the scholars should read up the details for themselves.

Illustrations, too frequently neglected, are absolutely necessary in teaching history. Utilise every available illustration. With this period, in particular, illustrations can be obtained without difficulty. Do not despise B.B. diagrams. Simple diagrams, consisting of a few bold lines which bring out the essential features, are all that is required. Plans of battles and sketch maps of battlefields should be utilised to illustrate the naval and military campaigns. Photographs, too, should be used.

Allow note-taking. This valuable aid is often totally neglected. With a little experience and encouragement the scholars will soon be able to draw up useful notes for themselves, and this is a splendid training. The advantages of being able to make concise, well-arranged notes at the end of a lesson are too well known to be dilated on any further here.

In conclusion, the teacher who wishes to teach history well must read widely. He who relies solely on the meagre information supplied in a text-book will never make a successful teacher of history. As an aid in this direction, we have selected a few books from which the desired information can be obtained. The literature on the nineteenth century is so extensive that we are only able to select a limited number of references, our selection of authorities being guided by their utility to teachers.

References.

The Life of a Century. Edited by E. Hodder (Illus.)	Newnes & Co.
Life and Times of Queen Victoria. (Illus.)	Cassell & Co.
Sixty Years a Queen. (Illus.).	Harmsworth & Co.
Life and Times of Nelson. (Illus.)	" "
Life of Nelson. Southey. Hutchinson's "*Standard Biographies.*"	
Life of Napoleon. Bourrienne. "	"
Battles of the Nineteenth Century. (Illus.)	Cassell & Co.
Life of Gladstone. Rt. Hon. J. Morley.	Macmillan & Co.
The Wonderful Century. Dr. A. R. Wallace.	
National Education. H. Holman.	Blackie & Son.
History of Our Own Times. Justin McCarthy.	

REGULATIONS FOR SECONDARY SCHOOLS.

SECOND YEAR—TERM III.

Africa in General.

1. **General View.**—Africa, the Dark Continent, so called from the dark skins of its inhabitants, its moral darkness, and lack of geographical knowledge of its recesses. How the reproach is passing away in part at least. Early knowledge of northern portions in time of Herodotus. Discovery of Cape of Good Hope by Bartholomew Diaz, 1486. Vasco de Gama rounded the Cape to India, 1497. The era of scientific exploration commencing with the discovery of the source of the Blue Nile by Bruce, 1768–70. Mungo Park and Clapperton in the Niger basin in 1778–1830. Livingstone, Burton, Speke, and Baker and the Nile and Zambesi sources. Stanley's search for Livingstone. Stanley and the Congo. The Emin Relief Expedition.

Comparison and contrast of shape, size, and coasts with other great land masses. Remarkably regular outline; 1 mile coast to 750 square miles; *cf.* proportion in other continents—Europe, though smaller in area, has 3000 miles more coast. Coast features. Islands. Vast lengths of coast open directly on to deserts. Mangrove swamps. Suez Canal converts Africa into an island. Note its commercial importance and its effect on traffic to the East.

2. **Relief.**—The continent of plateaux. No mountain axis. Whole mass of continent mainly rises abruptly from the coast. Great part of the interior is a saucer-shaped depression. Plateaux more elevated in the east than in the west. The desert features. No definite mountain systems; the best marked regions are the east coast, the west coast, and the Atlas Mountains. All rise from coast and break off inland into great plateaux. Atlas Mountains prevent moist winds reaching the Sahara. Point out sections of west coast mountain regions. The east coast mountains most important; the elevations from the Cape to the Limpopo. Peaks of the central section, Kilima Njaro, Kunei, and Ruwenzori. Abyssinian region of greater elevation than any other equal area in Africa. Snow-line here 13,000 feet. Peaks above 15,000 feet feed Atbara and blue Nile eight months in year.

3. **Rivers and Lakes.**—African rivers are coastal and continental. Most of the former, from the land configuration, are short, rapid, and deeply trenched. Continental rivers are inland and oceanic. Western watershed experiences greatest rainfall; eastern chiefly fed by perpetual snows. Chad region the most important inland basin. Classify rivers into three oceanic and three inland drainage areas. Nile, Congo, and Zambesi best represent the former. Note Atlantic area most important as in Europe and America. Sahara, Kalahari, and Eastern Horn are the inland areas. Point out typical rivers.

Congo.—Area of basin. Similar to Amazon basin in constant equatorial rainfall. Great volume of water. Trace source. The magnificent waterway, 15 to 20 miles wide, to Leopoldville broken only by Stanley Falls. Stanley Pool. Livingstone Rapids. Cataracts between Stanley Pool and the sea. Great length of waterways converging on Stanley Pool giving access to

great trade areas of the Zambesi, Nile, and Lake Tanganyika.

Nile.—Longest river in Old World. Its fascinating ancient history and its immense political and commercial importance. *Cf.* with Congo—Nile hampered by desert and cataracts in its middle course; Congo by forest jungles and cataracts in lower course. Lack of tributaries after entering the desert, and consequently no connection with distant areas. Egypt the gift of the Nile. The Barrage and its effects. The Delta.

Niger.—Sierra Leone hills have heaviest rainfall in Africa, hence volume of the Niger. Absence of tributaries. Possibilities of enormous trade, the main stream commanding Western Sudan, and the Benue the Eastern Sudan. Delta larger than that of the Nile.

Zambesi.—Half length of Nile but greater volume. The vague water-parting; some streams fall into either the Zambesi or the Congo according to the season. Commercial highway to and from the high-level lake region.

Of the lakes, only those of North America equal those of Africa in number and size. The saline lakes (Chad, Ngami, Rudolph). Chad an inland sea, in the rainy season as big as Switzerland.

Great Lakes of the High Eastern Plateau.—The Nyanzas; their area, special features, and details concerning their discovery and exploration. Lakes Tanganyika, Nyassa, Bangweolo. Show how small streams from the various lakes link up the greater river systems. Lake Dembea the reservoir of the Blue Nile.

Climate and Characteristic Products.—Extending over 70° of latitude there are great differences in climate. Owing to its solid, unbroken shape the vast bulk of the continent is little affected by the ocean. So much of the surface lies within the tropics that the main differences are due to elevation and moisture. More land in the northern than in the southern tropics. Continental north, therefore, hotter and drier than the peninsular south. Rainfall varies in a marked degree; west of the Niger it is 100 inches a year, or ten times that at Timbuktu. Greater difference between the hottest and coldest months and between day and night in the Sahara than in any coast region. Effect of the trade and anti-trade winds with regard to moisture. Fever-stricken coasts of West Africa. Narrow peninsular portion receives greater proportion of rain than the broad continental area, and consequently has more forest and less desert. West coast drier than the east. Note effects of Mozambique and Benguela currents. Fogs off Cape Agulhas (*cf.* Newfoundland and the Maelstrom). On the whole Africa is the continent of dry heat and perpetual summer, with sharply defined seasons of rain and drought.

4. **Vegetation.**—Much of the vegetation is distinctive if not particularly rich in variety. The similarity of the products of the extreme north and south. The limited flora of the desert and semi-desert regions, and the luxuriance of the hot moist regions. Great forest region of Central Africa, 300,000 square miles. Cotton, sugar, coffee, and indigo grow wild in parts of the continent. Discuss the Mediterranean region (orange, lemon, fig, vine, wheat, alfa); Sahara region (date palm and bulbous plants); Nile valley (cotton, wheat, pulse, papyrus); western equatorial region (dense forests, oil palm, manioc, banana, coffee, cotton, rubber); great eastern plateau (pastures and coffee); southern region (vine, maize, tobacco, wheat, tea, sugar, etc.). Note the most fertile regions are the most unhealthy; in healthier parts there is difficulty in obtaining native labour.

5. **Animals.**—Richness of African fauna. The large animals. Seventy species of antelopes. West equatorial region not favourable to animal life—gorilla and chimpanzee, elephant and hippopotamus. The monkey tribe well represented over vast areas. Great eastern plateau the home of lion, elephant, giraffe, zebra, crocodile, and rhinoceros. The camel and ostrich in desert regions. Locusts. Termites. Tsetse fly; note disappearance of this pest with the extinction of the "big game."

6. **Minerals.**—Continent only moderately rich in minerals. Iron exists in most of tropical Africa, especially rich in Atlas Mountains. Coal little worked except in Natal and Transvaal. Copper in Cape Colony, Darfur, and Atlas regions. Gold exists in many river-beds, especially on the west coast. Gold-mining in Rhodesia is extending. Transvaal, notably the Witwatersrand district, the seat of a gigantic gold-mining industry. Diamonds in Griqualand West (Kimberley) are highly important.

7. **People.**—Population. Africa the home of the negro; Mandingo tribe the finest type. Africa, "the home of the most man-like apes and the most ape-like men." Hottentots, Bushmen, Kaffirs, Zulus, Mashonas, Matabele. The representatives of the ancient Hamitic settlers; Egyptians, Copts, Nubians, and Somalis. The Semitic stock; Arabs, Moors, Berbers, and Abyssinians. The west coast negro tribes. The Arabic tongue of the north; the unwritten tongues of the negroes. The domination of European peoples. Mohammedanism in the north. The Christian mission field. The slave trade. Note black population in North America and discuss how affected by European agency. The ivory trade conducive to slavery owing to necessity for human porters. With the decrease in ivory, slavery has languished apart from discouragement by Europeans. The old slave-routes are still the chief channels of trade.

8. **Miscellaneous.**—There is abundant scope for individual taste and interests. The history of African exploration and discovery is full of thrilling incident. Discuss probable history of Africa if the continent had been reversed so that Cape Colony stretched northwards. Note difficulty in getting the natives to follow fixed employment, chiefly on account of the ease with which staple foods are obtained; in vast areas they grow wild or are produced with the minimum of exertion. Chinese labour in Transvaal. Hindoo immigrants in Natal and east coasts. Compare the various European spheres of influence.

Africa in Detail.

In a review of Africa in detail, point out the necessity of different treatment to a similar consideration of Europe. In the latter a high state of civilisation has made industry, and especially manufactures and the trade and commerce to which they give rise, a marked feature of national life. Africa is yet but on the fringe of civilisation; there are practically no manufactures even by the white settlers, and trade and commerce are concerned almost wholly with the raw products of the continent, and the importation of the manufactures of civilised nations, only the most utilitarian of which are in demand by the native peoples.

In Europe each country is best considered by itself;

in Africa it will be well to consider the continent in regions comparatively irrespective of political divisions.

1. **The Barbary States.**—Physical features mainly present the same characteristics. Productions and industries. The Tell valleys. Tafilet and Fezzan oases. Morocco; misrule. The Morocco Conference. Spanish possession; Ceuta—suggested exchange for Gibraltar with Britain. French domination of Algeria and Tunisia, and their consequent progress. French railways. The chief towns and their communications. The trade routes to the interior. Port of Algiers and its facilities for shipping. Tunis and its ship canal.

Tripoli is still a Turkish province. Trace caravan routes and the products carried.

Ancient Carthage. The descent of the Moors upon Spain. The Barbary pirates. Algeria as a European health resort.

2. **The Sahara.**—Note it is the western terminus of a belt of deserts stretching across the Old World. The sterility is caused by the absence or deficiency of rain. Sahara not a dead level sea of land destitute of vegetation; it is a low plateau crossed by smaller rocky tablelands with vertical cliffs. There are even mountain ranges east and west of Lake Chad which precipitate some rain in summer. Libyan Desert is a level tract of sand. Distinguish between the vegetation of the desert and the oases where cereals, cotton, and tobacco are grown. Centres of population dependent upon water supply. Fixed populations only in the oases. The nomads. Trade all done by camel. From the north come grain, cheese, and wool of the Barbary States, with textiles, tea, and sugar in exchange for gold, ostrich feathers, ivory, gums, and wax. Dates and salt are the local staples. Slavery still exists throughout the region. The chief routes are Kano to Tripoli, Timbuktu to Mogador, Lake Chad and Kuka to Fezzan, and the Wadai country to Benghazi.

3. **The Sudan.**—Consists of a coastal plain and a continental plateau extending from the Atlantic to Nile valley, between the Sahara and the peninsular plateau. Physical features in detail. People and their occupations. The stationary and agricultural black man. His chief characteristics. The mixed races, of which the Hausas are one of the best types; the chief carriers of these regions. Trade routes run east and west, chiefly on account of the direction of the rivers. The chief commercial centres, Kuka, Kano, Sokoto, Kong, Sulaga, and Ilorin. The Lower Niger and its oil palm, rubber, and ebony; the durra, millet, sorghum, cotton, and indigo of the central strip; ostrich feathers and goat-skins of the more arid northern strip, and the ivory of the forested strip in the south.

France and Britain divide the greater part of the Sudan between them.

(*a*) *Togoland* (German).—Lome, the capital. Colony trades chiefly with Sulaga and Yendi and the Kamerun country.

(*b*) *Portuguese Guinea.*—Bissao, the capital. Trades with the Futa-Jallon highlands *via* Rio Grande valley.

(*c*) *Liberia.*—Independent state, founded at the instigation of United States for freed negroes. An excellent example of the inability of the negro to rule capably for himself. Black rules white. Monrovia, the capital, exports coffee.

(*d*) **British West Africa** (Gambia, Sierra Leone, Gold Coast, Lagos, and Nigeria).—Physical features and productions in detail. The trading towns and stations. Railway enterprise; light railway from Freetown to Songotown and Rotifunk; Ptal valley line; Lagos to Abbeokuta. The deadly damp heat of some of the coast regions, *e.g.* Sierra Leone. Nigeria, owing to its elevation, more suitable for European occupation. The great Sokoto empire. The native West African regiments of Hausas. The Ashantee War; recent punitive expeditions. Note advance in cotton cultivation in response to Lancashire's appeal for raw material other than American.

(*e*) *French West Africa* (Senegal, Guinea, Ivory Coast, Dahomey, and the countries of Senegambia and the Niger).—Physical features, productions, and people, mainly, similar to those in the British possessions. Chief towns and trade routes.

4. **The Nile Region.**—Nile valley possesses five natural zones—(*a*) Lake reservoirs of the great eastern plateau. (*b*) Savannahs between Lado and Fashoda. The sudd-choked river and removal of the obstruction. (*c*) Steppe region from Fashoda to Berber, where a fertile rainy district gradually merges into a dry barren one. (*d*) The desert course. Evaporation so great that river loses volume as it nears the sea (*cf.* the Orange). Impeding cataracts. (*e*) Delta proper and the Fayum.

Pay attention to the two long rainy seasons and the short dry season between of the Savannah zone, which allow the production of rubber, gums, and cotton. Trade converges on Fashoda. The importance of Khartum as controlling three great waterways equalled by the commanding position of El-Obeid in respect to the caravan trade of the Eastern Sudan.

Egypt (Upper and Lower, Valley and Delta).—From its length difficult to govern (*cf.* Italy and Chile). Several sites tried for capitals—Thebes, Alexandria, and Cairo. The antiquities—Sphinx, Pyramids, and temples of Memphis and Thebes. Physical features—Red Sea littoral. Egyptian misrule. Revolution under Arabi Pasha. Bombardment of Alexandria. The Sudan War and the utter defeat of the Madhi. British occupation of Egypt and its economic results. Turkish interests. Cape to Cairo line; the northern section. Nile Barrage; details of construction, utility, cost, and repayment. Suez Canal; its commercial importance; saves 3000 miles on the Cape route Liverpool to Bombay. Half the population on the Delta. Towns. Imports and exports.

5. **North-East Africa** (Abyssinia and Somaliland).—Climate cooler than the Sudan. Italian pretensions in these regions, their defeat by Abyssinia; Eritrea and island harbour of Massawa. Volcanic plateau of Abyssinia. Prevailing winds and rainfall, and its effect on volume of the Nile. Inaccessibility of Abyssinia from the sea. People and productions. Abyssinia practically the only independent state in the continent. Chief towns. Historical features. Emperor Menelik.

French Somaliland.—Transit trade of the ports. French attempts to monopolise Abyssinian trade *via* railway from Jibuti. Effect of the line upon trade of Zeila. From railway terminus at Harrar caravans to the capital of Abyssinia.

British Somaliland—Towns and trade of the region. Recent trouble with the Mad Mullah.

Sokotra (British).—Strategic value of island. Aloes.

6. **East Africa.**—Physical features, especially moun-

tains, rivers, and lakes, in fuller detail. Importance of the lakes over the rivers as a means of communication. Effect of lakes on climate. Natural products. Occupations of the people. The Masai. Arabs and Hindus in commerce.

British East Africa.—The hot coast lands. Magnificent pastures between Mt. Kenia and Victoria Nyanza. Uganda and Unyoro. The Uganda Railway. Railway and lake transport. Coffee, cotton, and rubber possibilities. Chief towns. Mombasa Harbour. Zanzibar and its former importance in the slave trade. Value of the clove crop. Copra and chillies.

German East Africa.—Climate not so healthy as in the British territory. On the whole unfavourable to European settlement; Germans were late in entering the competition for African territory. Notwithstanding occupation slavery has lingered long in East Africa. Bagomoya is the end of an old slave-dealing track, but Dar-es-Salaam has a better harbour and easier railway facilities. Recent troubles with the natives. Future prospects.

7. **West Central Africa.**—Physical features, climate, and productions. The dense forests, degraded inhabitants, and lack of a common language cause the region to be difficult to govern.

Congo Free State.—The state of 900,000 square miles. How it came under the domination of Belgium. The vegetable wealth. The vile climate. The short length of service of European officials. Cannibalism, inter-tribal warfare, and slavery. Failure of Belgian methods of government. The waterways and commercial development. Chief trading centres, especially on the Congo. The obstructions in the Lower Congo necessitate a railway from Matadi to Dolo, and other lines are projected.

8. **Angola** or Portuguese West Africa.—The soil is extremely fertile, but the deadly climate retards European exploration, even if the Portuguese were more ideal settlers. Natural products entirely tropical; coffee, sugar, and cotton the chief. The outlets for produce of the region. The trading towns, especially Benguela and Loando. The railway from Loando to Ambaca and beyond.

9. **Zambesi Region.**—The relief. The Zambesi is the outstanding physical feature. Discuss its three natural divisions—a magnificent waterway, after receiving the Kwando, to the Victoria Falls; rapids in the central valley; shifting sandbanks in the lower reach and the deadly delta. The great Shiré tributary. Chindé channel of the delta. Coast lands in the possession of Portugal from Cape Delgado to Delagoa Bay. Portuguese neglect of their territory. British activity inland has quickened the old coast towns Quilimane, Sofala, and Inhambane, and given rise to Chindé and Beira as commercial centres. Laurenco Marques is the terminus of the east coast railway to the Transvaal.

British Central Africa.—Importance of the length of Lake Nyassa for trade. Physical features and suitability for European occupation. The Stevenson Road recently constructed. Chief trading centres and products, especially coffee, rubber, sugar, and cotton. The tsetse-fly and cartage of products. Necessity of railways.

Rhodesia.—Cecil Rhodes. Northern Rhodesia and its possibilities with improved communications. Victoria Falls Bridge. Southern Rhodesia and its healthy climate. Mashona plateau. Cape to Cairo line and its effect on settlement. The rising industries. Buluwayo, Salisbury, and other towns. Wankie coalfield. Zimbabye ruins; the ancient Ophir of King Solomon. The natives, especially the Matabele and Mashonas.

10. **Damaraland.**—Physical features. Kalahari desert and its many resemblances to the Sahara. Copper-mining in Namaqualand. Walfisch Bay (British) the best harbour. The railway to Windhoek and its possible extension to Vryburg and Witwatersrand.

11. **Bechuanaland.** — Extent of the Protectorate. Natural productions. King Khama. The railway and its towns.

12. **Cape Colony, Natal, Vaal-Orange Territory.**—Physical features in close detail. Climate and productions. Chief seats of industrial activity. The gold-mining industry and its labour problem. British and Dutch struggles for supremacy. The late South African War. The contending interests that still cause unrest. Better position of Natal in this respect. The industrial and commercial progress of the various divisions, and particularly future prospects. Cape to Cairo line.

13. **African Islands.**—The Atlantic islands, especially those in British possessions, and their value as coaling stations. The French in Madagascar. Madeira. Canary Islands. Cape Verde Islands.

Aids to Information.—Of numerous text-books, all presenting more or less useful features, *Africa* (Black's School Geography, by L. W. Lyde) is particularly useful. The lessons provide a basis for extension in almost any direction dictated by individual taste of teachers. *Africa in the 19th Century*, by Edgar Sanderson (Blackie), gives a comprehensive survey of social and industrial conditions that is difficult to excel. Accounts of the exploration of the continent by the great travellers, from Livingstone to Stanley, are valuable from many points of view; in this direction *Africa as Seen by its Explorers* (Edward Arnold) is full of interest. British interests are largely concerned in South Africa, and invaluable useful matter is obtainable in the publications issued by the Agents-General, such as *Emigrants' Guide to South Africa*, *Natal Handbook*, etc.

TEACHING NOTES ON "THE HISTORY OF LONDON."

B.—SAXON, NORMAN, AND MEDIÆVAL LONDON.

I. Saxon London.

1. Introduction.

(*a.*) In the year 457—eight years after the Romans left Britain—the following entry was made in the Saxon Chronicle: "This year Hengest and Æsc, his son, fought against the Britons at the place which is called Creganford, and there slew 4000 men; and the Britons forsook Kent and in great terror fled to London."

(*b.*) Until the year 604 there is no further mention of London.

2. Effects of Conversion to Christianity.

Several churches were built—Churches of St. Osyth (from St. Osyth, queen and martyr, the mother of King

Offa), St. Dunstan, St. Swithin, St. Botolph, and St. Edmund the Martyr.

3. The Danes in London.

(*a.*) For twelve years the Danes held London; made it a city of ruins—wall ruined, churches destroyed, old wooden bridge (London Bridge) damaged, gates battered in, and houses burned and looted.

(*b.*) Canute subsequently besieged London. He could not take the city, but obtained possession of it by the Treaty of Partition drawn up between Edmund and Canute.

(*c.*) Sovereignty of Danes shown by St. Olave's Church and the Church of St. Clement's Danes.

4. Alfred and London.

(*a.*) "London was founded rather more than a thousand years ago by King Alfred, who chose for the site of his city a place formerly fortified by the Romans, but desolated successively by the Saxons and Danes" (Loftie, *Historic Towns:* "London").

(*b.*) Alfred rebuilt the wall and appointed a governor. The city was "repaired, honourably restored, and made again habitable" (Stow).

(*c.*) The only memorial to Alfred in London is the name of *Battle Bridge*, St. Pancras, where he defeated the Danes on one occasion.

5. Life of a Saxon Citizen.

(*a.*) *A Trader.*—Lived in great comfort; everything made in the house; flour ground, bread baked, meat and fish salted, linen woven, garments made; benches; tables on trestles; tapestry, weapons, and musical instruments on walls; breakfast at nine, "noon meat" or dinner at noon, "even meat" or supper in the evening; exported hides, wool, iron, tin; imported wines, spices, books, incense, &c.

(*b.*) *A Craftsman.*—Lived in wooden houses (two rooms) or in hovels; rough living, many hardships; well fed, turbulent, and independent; always in danger of fire; lived in plenty; sufficient work for all; attended the folk-moot and ward-moot; streets dirty, muddy, and generally foul-smelling.

6. Results of the Saxon Occupation.

(*a.*) Many churches founded (see Section II.). A church was built by King Ethelbert on the site of St. Paul's, and one on the site of Westminster Abbey. These churches had a far-reaching influence on the formation of the national character.

(*b.*) London was divided into wards.

(*c.*) Guilds were founded.

[Serious fires occurred in 764, 798, 801].

II. London under the Normans.

1. London the Chief City.

(*a.*) A rich and busy town, which prospered considerably under Norman rule.

(*b.*) The reasons for London's importance were:—

(i.) Its accessibility.

(ii.) Its advantageous position with regard to Gaul, Normandy, the countries of the Baltic, &c.

(iii.) The special privileges granted by William I.

(iv.) Its defence: the Tower of London.

(v.) The consolidation of the races.

2. What the Normans did.

(*a.*) Built the *Tower of London*—the *White Tower*—in 1078; a great fortress. The work was entrusted to Gundulph, Bishop of Rochester.

(*b.*) Special privileges were granted to the citizens by William I., and later by Henry I.

(*c.*) "The prosperity of the country increased enormously during the long reign of Henry I." (Loftie).

III. Mediæval London.

1. Religious Influences.

(*a.*) Numerous monasteries, nunneries, colleges of priests, parish churches and hospitals (religious houses) were erected; 120 churches; there were buildings, the homes of the Black Friars (*Blackfriars Bridge*), White Friars (*Whitefriars Street*), and Crutched Friars, who wore a red cross on their backs and carried an iron cross in their hands.

(*b.*) "The Church was everywhere; it played not only an important part in the daily life, but the most important part" (Besant).

(*c.*) Results of this influence: order; law; respect for human life; standard of morals and conduct regulated; learning—a splendid discipline.

2. London's Trade and Commerce.

(*a.*) Various companies and guilds formed. Chief regulations: carrying on of certain trades restricted; servants not to be enticed away; goods not to be sold by candlelight; false work to be taken to the Mayor and Aldermen of the Wardens; rate of wages fixed; no underselling allowed; no one was allowed to work in the city, or make anything for sale in the city, unless he belonged to a company or guild; trade protected in every way. "In the first half of the fourteenth century the guild system reached its highest point of efficiency. For two centuries afterwards this form of organisation continued to be adopted by one industry after another as it arose in each town" (Professor Ashley).

(*b.*) London a busy town: founders, weavers, upholsterers, basketmakers, vintners, clothworkers, armourers, tailors, drum-makers, shoemakers, furriers, and many others; continual noise — hammers of carpenters, blacksmith's forge, grating of founders, rumbling of waggons, shouting of prentices, continual ringing of bells of monasteries and churches, &c. "No noisier city in the world."

(*c.*) Great commerce carried on. Commercial treaties formed with Brittany, Burgundy, Portugal, Castile, Genoa, and Venice.

(*d.*) Trades were confined to certain localities, hence Bread Street, Poultry, Fish Street, Wood Street, &c.

3. The People.

(*a.*) *Houses and Streets.*

(i.) Wealthy lived in capacious palaces; gate (a pair of wooden doors) led into open court. [*Staple Inn, Barnard's Inn, Clifford's Inn, Lincoln's Inn* are examples.]

(ii.) Poorer classes lived in one-storied hovels built of wattle and clay.

(iii.) The main streets were "broad, well built, and picturesque" (Besant); others were narrow, unpaved, and filthy, with every kind of refuse.

(*b.*) *Dress.*—Much importance was attached to dress, indicative of the wealth of London. Distinctive costumes. [Consult Miss Bateson's *Mediæval England* (*Story of the Nations*).]

(*c.*) *Amusements.*—Shows; sports and amusements of every kind; numerous holidays; skating (Moorfields), singlesticks; football; cards; cock-fighting; stage plays; pageants frequent; May Day festivities—"the prettiest festival in the world" (Besant); morris dancing; bonfires—objects: (i.) a reconciliation, as all shared in the preparatory labours; and (ii.) to purge the air of infection; wrestlings; shooting with the bow; the pipe and tabor were the chief musical instruments.

4. Famines and Plagues.

Although life was enjoyed to the utmost, yet there was always the fear of famine and plague; filth accumulated, no sanitation, streets narrow and foul; plagues occurred in 1348, 1361, 1367, 1369, 1407, 1478, 1485, and 1500; the famines were grievous—horse-flesh and dog-flesh eaten, sometimes even children (Stow); bread was made from fern-roots, and so on.

5. Mediæval London in General.

(*a.*) Mediæval London was in advance of any of her competitors, and "was an example of a mediæval city at the highest point of development" (Miss Bateson).

(*b.*) Well governed; good courts of law; immense trade; trade was organised and regulated; growing commerce; numerous religious institutions; food plentiful; great wealth.

(*c.*) "I do not think that there is any city with more commendable customs of church attendance, honour to God's ordinances, keeping sacred festivals, almsgiving, hospitality, confirming, betrothal, contracting marriages, celebration of nuptials, preparing feasts, cheering the guests, and also in care for funerals and the interment of the dead. The only pests of London are the immoderate drinking of fools and the frequency of fires" (FitzStephen, *tempo* Henry II.).

Chief Civic Events.

610. First church built on the site of St. Paul's Cathedral.
616. First church built on the site of Westminster Abbey.
1078. *Tower of London* built.
1087. *St. Paul's Church* destroyed by fire; new church built (completed in reign of Henry III.).
1091. Dreadful gale occurred—destroyed 600 houses and several churches, damaged the Tower, and swept London Bridge entirely away.
1135. Great fire occurred.
1176. *London Bridge* rebuilt, this time built of stone.
1189. First *Mayor* (not Lord Mayor) elected—Henry Fitz-Aylwin.
1265. In the Parliament of this year London was represented by seven members.
1285. Great water-conduit in Cheapside begun.
1348. Great plague—50,000 Londoners perished.
1406. 30,000 people perished in London alone from the plague.

COMMON-SENSE NEEDLEWORK.

BY MISS FLEMING,

Authoress of "How to Teach Needlework," "Pupil-Teachers' Needlework," "Sewing-class Guides," etc.

BACKSTITCHING.

STITCHING or backstitching is the making of a row of *back*-stitches, by putting the needle *in*, exactly where it was drawn *out*, in the preceding stitch. The beauty of the work depends upon the uniform size of the stitches, and the exactness of the lines formed.

It is so rarely done by hand now in plain needlework, that there would be little necessity for referring to it, were it not for the fact that the stitch itself is often required for finishing off such things as gussets, setting on a tape, making the bottom of a vent neat, etc. It occurs also, in one form or other, in many branches of fancy needlework.

Formerly fronts, collars, and cuffs of shirts, and necks and wristbands of nightdresses, were ornamented by means of this stitch, but nowadays sewing-machines do the work much more quickly.

Canvas, or very coarse linen, is preferable to finer materials for teaching purposes, so that the correct shape and formation of the stitches can be easily seen, without any straining of the eyes.

Before commencing to sew, a thread is drawn, in order to keep the stitches straight, and to allow them to fall into place properly. The sewing itself replaces the thread drawn out. When the stitch is required to be worked *across* the material, where a thread cannot be drawn, a coloured tacking-thread will form a guiding line.

The teacher will first show how to draw the thread. She will pick out with a needle about half an inch, or sufficient by which to hold. She will grasp this with her right hand, and draw the material along from right to left, bit by bit, gently, though firmly, or the thread will break. As stitching would serve no useful purpose on single material, either a band must be made, or the material doubled down, so that two thicknesses may be sewn.

The A. L. Sewing Illustrator (Messrs. E. J. Arnold and Son, Ltd., Leeds) is specially useful for the teaching of this particular stitch. The needle is run along a few threads on the underside to fasten the cotton. It is then brought through to the front, carried back from left to right, and inserted two threads from the place where the cotton came out. Four threads are taken up on the needle this time, two coming between the needle and the cotton, and two beyond, and to the left of, the cotton. The needle is again put back two threads, and it again takes up four. It must be put into exactly the same hole as the previous stitch, or a break will be made which destroys the regular, even appearance so necessary for good work.

After the teacher has demonstrated on the Illustrator, two or three girls should do the same. Before the class commences to work, it would be well to show how, when the thread is pulled too tightly, spaces are left between the stitches; when the cotton is left too loose, an untidy, irregular line is the result; and when the needle is not put back into the same hole as the last stitch, a break is formed in the line, and the beauty of the work is spoiled.

It is not advisable to count threads in ordinary

sewing, as the strain on the eyes is too great. That is probably one of the reasons why backstitching is used less now than formerly.

The old-fashioned rule for working is, however, to take two threads and leave two, but that number may be modified, as it depends entirely upon the fineness of the material.

To finish off, the needle is taken through to the wrong side, and darned in and out for about a quarter of an inch.

Setting on Buttons.

Apparatus. — A. L. Sewing Illustrator, pierced buttons (two or four holes), needles, cotton, thimbles, and prepared bands.

The teacher's demonstration specimen could be manufactured from a circular piece of white paper with holes in it, to represent a button. This can be sewn on the Illustrator before the class. She should also have at hand garments exhibiting loose and broken buttons, to show how they are to be treated—the one cut off and replaced by a new one, and the other made secure by a few additional stitches.

A conversation might take place on the ways in which girls can be useful to mother by sewing buttons on their own garments, etc.; the pleasure it gives to ourselves, as well as to others, when we are neat and tidy.

It would be a good opportunity to point out the necessity for examining all clothes after the weekly wash, and to encourage the girls to undertake the regular repairing of their under garments by sewing on the buttons. It would be well also to educe the use of buttons, and why they come off. Different kinds, such as pearl, bone, and metal ones, might also be exhibited to illustrate the purposes they serve.

This constant reference to everyday home duties is most valuable, and gives the parents ample proof of the actual relationship that exists between school work and home life. The importance of early training in habits of neatness, and its beneficial effects in after life, are too obvious to need further remark.

After having been taught how to make buttons secure, a comment from the teacher will be a sufficient reproof, when a child appears with her pinafore or apron pinned.

Buttons are not sewn on single material but on double, such as a hem, fold, or band. When it is necessary to sew one on single material, a small square or oblong, of calico or tape, is hemmed underneath for additional strength. The same thing is also done when a hole is torn in an article by pulling off the button.

Buttons are placed a little distance from the edge of the garment, so as to allow the button-hole to come entirely over the band.

Two points are to be emphasised—

(1) The button must be sewn on strongly, yet loosely, with suitable cotton.

(2) It must be stemmed.

Demonstration.—The cotton is first secured on the wrong side by two or three stitches, just under where the button will come. The needle is put through the material from the under-side, and through one of the holes, coming out in front of the button. It is then passed straight across to the next hole and put through again, coming out at the under-side this time. The needle is now taken back to the place from which it originally started, and the whole is repeated several times to afford sufficient strength. Some little difficulty may be experienced at first, in guiding the needle to the hole of the button from the under-side, but practice soon makes it easy. The thread should not be drawn too tightly.

Where there are four holes in a button, the two top ones may be treated as described above, and the two lower ones in the same way, or, the cotton may be taken across from corner to corner.

After the button is made secure, the needle is taken through between the garment and the button, and the cotton is wound round five or six times. This is called "stemming," and is for the purpose of strengthening, and also to make a place for the button-hole.

To fasten off, put the needle through to the wrong side, and secure with one or two stitches.

Unpierced linen buttons are sewn on by means of backstitches, which may take the form of a circle, a star, or any other shape that looks neat and makes the button firm. The different methods can be shown on the Illustrator. The stemming must not be omitted.

Herring-bone Stitch on Canvas.

Apparatus.—A. L. Sewing Illustrator, squares of canvas, rug needles, and coloured darning cotton.

Conversation.—During this the girls should be made to understand that the canvas is only used for teaching purposes, and as an introduction to flannel work.

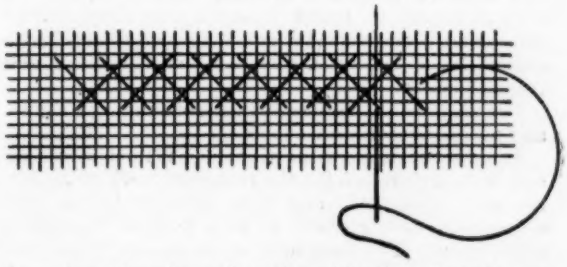
Educe, by referring to the specimen worked on the Illustrator, that two threads are left between the stitches in both lines, and that the little crosses on the top row come between the crosses on the bottom row and *vice versâ*. Also that the stitch is worked from left to right on the wrong side of flannel, and that it forms two rows of stitches on the right side.

In some parts of England the stitch is named "Cats' teeth," and in other parts "Catch stitch." It is used principally for enclosing the raw edges of joins and hems in flannel-work, and sometimes for over-casting dress seams when the material is very loosely woven. Of late years it has been somewhat extensively applied to fancy work and dressmaking, for joining silk and lace together to form an open-work insertion.

The cotton is secured by a few darning stitches. The needle is drawn out, put in four threads to the right, and four threads down, and takes up two threads. It is now put in four threads to the right, and four threads up, and takes up two threads. These two steps are repeated.

Turning the Corner.

To turn the corner, stop at the upper part of the stitch where the cotton comes out. Count as before



down four threads, and to the right four threads, but this time point the needle *upwards*, and take two

threads. Now turn the canvas round and start the next side. Go on working from the upper cross of the stitch which is already made. Put the needles in to the right four threads, down four threads, and take up two. The needle will come out of the lower part of this stitch, in exactly the same hole as the last stitch of the first side. See Diagram.

When the square is finished, darn the needle in and out on the under-side to fasten off.

Herring-bone on Flannel.

Apparatus. — A. L. Sewing Illustrator, strips of flannel, needles, and coloured cotton, and one correctly herring-boned specimen for every two girls. The last lesson would produce a number that could be used for the purpose.

Conversation.—On (*a*) The difference between calico and flannel—(1) in appearance; (2) in the touch; (3) in the working: (*b*) The need for wearing flannel in England.

Flannel should be torn, not cut, because, if the material has been drawn crooked in the rolling of a piece, it will wash straight; but if cut straight, it will wash crooked. It is too thick to turn down twice for felling or hemming, so all edges are left raw and overcast by herring-boning, which flattens seams, and makes a join neat and firm. As flannel shrinks in washing, the herring-bone stitch, being loose, is eminently suitable for it.

The right side of flannel is woolly and fluffy, and is called the nap or ply.

The girls will have done so much fixing by this time, that they will be able to turn down and fold and tack the exercise evenly themselves.

The herring-bone stitches should be four threads of the material in length, just as they were on the canvas.

If the girls look carefully at the Illustrator, they will notice the regular recurrence of the crosses of the stitch, over the two threads between every couple of stitches. Bearing that in mind, they will produce straight herring-boning on the flannel.

The cotton is fastened by means of one or two darning stitches under the upper fold of the flannel, on the wrong side.

In working the stitch, the needle must go through both thicknesses of flannel on the upper row. The lower row of stitches comes just below the raw edges of the fold.

A Flannel Patch.

Apparatus. — A. L. Sewing Illustrator with two squares of herring-bone stitch previously worked. Specimens of herring-bone stitch worked on flannel, corners worked on canvas (selected from those worked on during a previous lesson), strips of flannel large enough for a patch to be taken off, pins, needles, and coloured cotton.

Conversation.—The different kinds of flannel garments, and the parts that wear out first.

It must be made clear that new flannel is cut up only as a preparation for the necessary work of repairing worn garments; and that, after the lesson has been given, each girl will be in a position to mend a hole herself. The class must be shown how to find the selvedge (by pulling), and the right side (which is more fluffy than the wrong).

When this is done, a pin is placed in each of the lower corners to indicate both selvedge and right side. After the patch is cut off the pins remain, to show that the sides so marked are to be parallel with each other.

A square will be cut from one of the lower corners. That shape is only for convenience, as the flannel patch may be either oblong or triangular, so long as it fits the place to be mended. The larger piece of flannel represents the garment, and requires a hole cutting in it.

The patch must be pinned quite straight along the warp and woof threads, and also be so firm as to prevent slipping. The right side of the patch, with the "nap" falling downwards, is to be placed on the wrong side of the garment to be mended. The fixing stitches must be kept quite even.

Probably some teachers may disagree with me on the next point, but it is a matter on which each must use her own judgment.

I have found it better to herring-bone the patch on the *wrong side* before cutting it out on the right.

The working stitches form a better guide for cutting out than the fixing stitches; it is less trouble for children when dealing with actual garments, and there is less possibility of the work becoming disarranged, when awkward repairs are being made.

To commence, the needle is slipped between the two flannels, and a tiny stitch made, to keep the end firm. The herring-boning must be regular and even. A fresh inspection of the flannel specimens, and a revision of the method of working the stitch on the Sewing Demonstrator, would probably prevent the lopsided stitch so often seen. The two threads taken on the needle at the apex of the triangle come *between* the stitches of the lower side.

Some needlewomen commence working in the middle of a side, and others in the corner. Probably children manage to get the corners neater if they commence in the middle of a side.

The canvas corner will show the exact formation of the sewing, in that part of the patch. When the work is finished on the wrong side, the article is turned over and the hole cut square on the right side, the inside square being about half an inch from the outside square. It is completed by the herring-bone stitch.

If the Illustrator is turned round it will show how the patch looks on the wrong side.

The method described is adopted in the repairing of all flannels, but as the part immediately surrounding a hole in a worn garment is usually thin, the patch will need to be sufficiently large to cover both.

An inch larger every way gives a fair working proportion.

Fuller details for mending garments will be given in a later chapter.

Needlework exercises in themselves have little value unless they are applied to the making or repairing of clothing, but a good teacher will inculcate thrifty ideas with every lesson she gives in sewing. A "mending day" should always follow when a new exercise has been taught. Petticoats, vests, night-dresses, and any garment made of woollen material, will provide practice for the class.

NOTES ON AN EXPERIMENTAL COURSE OF LESSONS ON PLANT LIFE AND SOIL.

BY EDWARD J. RUSSELL, D.SC. (LOND.),

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(*Continued from p.* 33.)

Constituents of Soil—(*continued*).

THE presence of organic matter in soil, which was demonstrated in Experiments 63 and 64, is readily explained. Leaves, roots, and other parts of plants decay in the ground, leaving organic residues, and a certain amount of animal matter also gets into the soil.

Experiment 65.—Determine the amount of moisture and of organic matter in a soil with which the children are acquainted. The soil is allowed to dry in the air for two or three days, it is then somewhat broken up in a mortar, stones are removed either by hand-picking or by sifting, and a sample weighing about 10 grams is taken. It is now necessary to dry at 100° C., and the usual method of doing this is to heat the soil in an evaporating basin, placed in a steam oven. If a steam oven is not available, place the soil in a wide specimen-tube or weighing-bottle, put this in a wide-mouthed bottle through which a current of air is drawn by means of an aspirator, and immerse in a tin of boiling water. After two or three hours weigh again; the difference gives the amount of moisture.

Then transfer to a metal dish or large crucible, ignite over a bunsen burner, and finally, if possible, over a blowpipe; weigh again when cold. The loss of weight is mainly organic matter, but includes some moisture not evolved in the first heating.

Soils analysed at the Agricultural College at Wye have shown the following results:—

	A Clay Soil.	A Sandy Soil.	A Rich Garden Loam.
Loss at 100° (moisture) . . .	4·5	0·8	3·0
Loss on ignition (organic matter).	6·0	1·5	4·5

It is evident that the residue, the purely mineral part, forms by far the largest proportion, especially in a sandy soil, and even in a rich garden soil it forms about 90 per cent. of the whole. This mineral portion is divided into sand, clay, and chalk, but small quantities of other minerals are also present.

Sand and Clay.

Experiment 66.—Label three large beakers A, B, and C, weigh about 10 grams of soil into a small beaker, add water, and stir up with a pestle made by fixing a glass rod into a cork. Allow to settle for two minutes, then carefully decant into A. Repeat the process several times, and when you notice a change in the colour of the liquid, decant into B; finally, when the liquid is nearly clear, decant into C. Leave standing till the next lesson, and examine the beakers. The liquid in A is generally still turbid, and there is a black, slimy deposit; in B the liquid is clearer, and the deposit is probably lighter in colour; C is probably clear, whilst the original beaker contains coarse particles of what the Wye children called "grit," but what is conventionally known as "sand."

Experiment 67.—Repeat the experiment with sea sand—no turbidity is produced in any of the beakers, and no slimy deposit is obtained; the bulk of the material remains in the original beaker. This similarity of behaviour is the justification for calling the coarse particles of soil by the name "sand."

Experiment 68.—Obtain some clay, if possible ground or milled clay, from a brickworks, and repeat the experiment with this; an almost indefinite amount of turbid liquid can now be obtained, and no coarse, gritty particles are left behind. At the end of a few days the beakers contain the slimy deposit, but the liquid remains turbid for some time.

Although clay remains suspended in water for a very long time, especially if a little ammonia is present, it does not follow that clay is lighter than water. Stokes showed many years ago that the velocity of a particle falling through a liquid varies as the square of the radius, and is equal to

$$\frac{2g}{9\eta}(\sigma - \rho)a^2$$

where a = the radius of the particle, σ its density, and ρ = the density of the liquid, and η = the coefficient of viscosity.

For clay $\sigma = 1{\cdot}5$, for water at 16° $\eta = {\cdot}011$, and ρ of course = 1: it is evident that particles of diameter ·0002 mm. will take a long time to settle.

There is no difficulty in showing that clay is really heavier than water.

Experiment 69.—Make small pellets of clay, drop them into water; observe that they sink at as rapid a rate as sand particles. Now rub one of the pellets between your fingers in the water, and notice that the fine particles rubbed off float. The conclusion to be drawn is that, although clay is heavier than water, it floats because the particles are so small.

Chalk.

Examination of some soils reveals the presence of white particles which effervesce on treatment with acid. Frequently no such particles are seen, but the soil as a whole effervesces with acid. If this is the case with the soil under examination, proceed as follows:—

Experiment 70.—Put about 20 grams of soil into a flask provided with a thistle funnel and delivery tube, add hydrochloric acid, and pass the gas evolved into lime water. A turbidity is produced indicating the presence of carbonic acid. Try sand and clay in the same way; in general, they give no effervescence with acid, showing that our scheme is not yet complete, and that there is some constituent of which we have not taken account. Now try chalk; observe that there is vigorous effervescence. The evolution of carbon dioxide from soil suggests, though it does not prove, the presence of chalk in the soil. If chalk or limestone occurs near at hand, as at Wye, the evidence is more complete. In other cases, local knowledge will guide the teacher in his proof of the presence of chalk in the soil.

There are, however, some soils, especially light sandy ones, which give no effervescence with hydrochloric

acid, and contain only small quantities of chalk; it is usually necessary to add lime or chalk to these soils in order to grow good crops.

We have now shown that soil contains:—

Moisture, Organic matter,	from 2 to 10 per cent.
Clay, Sand, Chalk,	90 to 98 per cent., the chalk, however, being very variable.

We have further based our distinction between sand and clay on the size of the particles, and have applied the name *sand* to coarse particles which sink quickly in water, and *clay* to finer ones which sink more slowly. This distinction is to be borne in mind in performing the following experiments.

Action of Running Water on Soil.

Experiment 70.—Take three clear glass bottles of widely different capacities, one small (A), one large (C), and one intermediate (B), fit with corks each perforated by two tubes, one of which reaches the bottom of the bottle, the other of which just passes inside the cork. Put about 10 grams of soil in the smallest bottle, pass a stream of water gently through. Observe that there is soon no turbidity in A, and that only coarse particles are left. The finer ones are carried on to B, where some of them deposit; still finer ones deposit in C, and a turbid liquid passes on and may be collected in a large beaker.

The velocity of the water current is evidently greatest in A, less in E, and smallest in C. The experiment affords ocular demonstration that running water will carry away the finest soil particles, leaving coarser ones behind, but that if the pace slackens, some of the solid matter will be deposited.

The Wye children knew from experience that the river flowed more quickly in places where, owing to the shallowness and the pebbly bottom, paddling was possible, than where the bottom was muddy and the stream deeper. They were now able to connect all these facts. Where the space was small the water flowed quickly, taking with it the fine particles and leaving only the sand and gravel; where, however, there was a greater width or depth, the speed of the water slackens and fine particles are deposited.

A very interesting illustration of this is found near Wye. The river flows through a large park, and years ago the owner of the park, wishing to enhance its beauty, constructed a lake, and made other artificial water-courses. For a time all went well, but the reduction in speed of the river, in consequence of the greater area of water, caused a deposit of solid matter, which has gradually filled up the lake, and now it is little more than a marsh.

The bend of a river furnishes another illustration. On the concave side the water moves with a higher velocity than on the convex side, consequently the bank is eroded, the channel deepened, and the bottom covered with pebbles or coarse gravel. On the other side, where the velocity is less, solid matter is deposited, and a bank gradually forms. In course of time this leads to remarkable changes in a valley: the river alters its course, beds of gravel and of earth are produced, lakes may be formed, as in the valley of the Mississippi, and other changes are brought about.

RADIUM, AND ITS UTILITY TO MANKIND.

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MANY people are wondering what permanent benefits mankind will derive from the various discoveries connected with radium and other radio-active bodies. Anything written from this point of view will be more or less speculative, though the sequel will show that there are a number of eminent workers in science doing their utmost to press the wonderful properties of radio-active substances into the services of man.

The late eminent astronomer, Dr. A. A. Common, shortly before his death, acquired the patent rights for the adaptation of radium in his collimator gun-sight, for both day and night work.

Radium and Diamonds.—It does not fall to the lot of many to experiment with *diamonds* and *radium*, but such has been the fate of Sir William Crookes, who has carried out a number of highly interesting experiments in this connection, the results of which he has brought to the notice of the Royal Society. Sir William finds that in the presence of radium the diamond becomes phosphorescent, and that it shines during the whole course of the experiment. The stone was subjected to this influence for many weeks, the result being a gradual change in colour, which was probably due to the constant rate of vibration in which the diamond had been kept by the radium. Various stones were experimented upon, and it is most likely that both chemical and physical actions were set up. Yellow stones were changed to a pale blue-green. Some state that the yellow colour of the diamond is due to the presence of iron in what is known as the ferric condition. Should this be so, the colour-change produced by the radium may be due to the reduction of the iron to the ferrous state, as ferrous salts are usually pale green. Alterations produced in this way may become of commercial importance; for if "off-colour" stones can be lightened, their value will be considerably increased, whilst should a long exposure impart a decided colour, the value of the diamonds, as fancy stones, would be greatly enhanced. Further experiments have shown that after a period of five weeks the diamonds were still radio-active. This is all the more remarkable when it is known that during ten days of that time the stones were heated in a mixture of concentrated nitric acid and potassium chlorate. This fact alone shows that the effect produced by the radium is not a mere surface one, but a deep-seated phenomenon involving layers well beneath the surface.

Radium and Disease.—It is, however, when we pass from the effects of radium on inanimate to the effects produced on "animate" matter—or had we better say "living matter"—that we *begin* to realise some of the possible and probable benefits which may accrue to humanity from researches on radio-activity. Lord Blythswood has found that radium has the power of rotting cambric in four days, thus establishing beyond a doubt the destructive action of this wonderful substance on vegetable matter. Confirmation from other sources is not wanting. At one of the Royal Society Conversaziones, Mr. Henry Crookes, A.R.S.M., exhibited several plates which aroused considerable in-

terest. These plates showed the effect of radium on bacteria. Various cultures had been exposed to the action of 10 milligrams of radium bromide through a mica screen, at a distance of 1 inch from the surface of the plate. Afterwards the plates were incubated for twenty-four to forty-eight hours. In every case it was found that the microbes were killed where they had been exposed to the radium emanations. This germicidal action applied to pathogenic bacteria will be of inestimable value to man. Something has already been done in this direction, and it is hoped that as the result of further research much more will be accomplished. One very natural question at this stage is, are these wonderful properties of radio-active substances being turned against those terrible scourges—cancer and consumption—of humanity?

Radium and Cancer.—Cases of successful treatment of minor forms have been authenticated, but the reader is warned against taking for granted some of the wonders which appear in the ordinary press, as it is certainly very terrible to rouse in the minds of sufferers hopes which may never be fulfilled. Rodent cancer has been attacked with considerable success. Dr. Sowers, a distinguished physician of Washington, D.C., has found that radium rays have a marked curative effect on external cancers, but *not* on deep-seated cancers. The term "cancerous growth" is so comprehensive that it is necessary to be most guarded in statements with regard to cures of any form of cancers. Still, undoubted evidence exists that rodent ulcers and some superficial cancers react to radium in much the same way that they do to X-rays. Many medical men vouch for radium cures of the kinds just stated. There are, however, others who have failed to bring the treatment to a successful issue. Such cases, of course, require further investigation, and possibly, as our knowledge increases, a still greater measure of success may be attained. No one knows what the future may hold, and various compounds of radium are now under trial as to their effect in different cases. No really reliable case of a cure of deep-seated cancer is yet to hand. Medical men using radium for therapeutic purposes should exercise great care, as it is as potent for evil as for good. Too continuous an application causes such a destruction of tissue that many months elapse before healing takes place.

Radium, Thorium, and Consumption.—Professor Soddy—one of the greatest workers on radio-activity—has made a number of valuable suggestions for turning the special properties of radium, and its near relation thorium, to account in the treatment of consumption. A detailed account of these suggestions is beyond the scope of this article, but the main points may be referred to. At the outset, it may be said, that in the light of the undoubted germicidal action of radio-active emanations there is every probability of thorium and radium becoming powerful weapons in the fight against consumption. The emanations from these sources differ only in the intensity of the effect they produce. Radium is many many times more powerful than thorium, and consequently must be used with considerable caution. Yet it must not be assumed that thorium need not be considered further. The patient under treatment—suggests Professor Soddy—should breathe air with which is mingled some of the emanation of one of these substances, probably thorium emanation, as there are indications that radium is too violent in its action. The easiest and best way of getting the emanation mixed with the air is to dissolve the radium or thorium salt in water, when the emanations freely escape in the air. It is hoped that some of the active material may be deposited in the lungs and there destroy the microbes, which would then give the patient a chance of recovery. As an indication that great care is necessary in applying the radium treatment, it may be mentioned that mice, frogs, and other small animals allowed to breathe an atmosphere containing radium emanations for a few days, afterwards sickened and died. Which substance—radium or thorium—will have the greatest sphere of usefulness has yet to be decided, though there are several points in favour of thorium. Doctors have to set to work both carefully and slowly, as the ultimate effect may not be what is desired. Compared with radium, thorium is obtainable in large quantities, and it would be quite easy to use the emanations from 2 or 3 lbs. of a thorium compound in treating a single patient. Further, thorium nitrate is a very soluble salt, and very suitable for this purpose, if precautions are taken to neutralise, by means of ammonia, any free nitric acid which may be formed. The longer a patient breathes through a thorium solution the greater the dose of the emanation, whilst in the case of radium the greater part of the emanation is inhaled at once, and the radium solution must be left tightly stoppered, in a suitable vessel, to recover itself. The "excited" radio-activity, which these emanations have the power of calling forth, is very important, as it remains in the air-cells of the lungs after the emanations themselves have been exhaled.

Radium and Lupus.—Radium is also battling successfully with that fearsome disease, Lupus (literally "the wolf"). This horrible disease is due to certain microbes settling and multiplying in the skin tissues—frequently of the face. In fact, to put it briefly, lupus may be described as an "exterior consumption" visible to the naked eye in the terrible sores that are caused by the lupus microbe, which is practically the same as that causing "consumption of the lungs." In using radium against lupus much care must be exercised, as too long or too frequent applications may do as much harm as good, by destroying healthy cells and tissues at the same time as the diseased parts. There is not the slightest doubt that repeated and careful applications of radium will drive away the merciless "wolf." The radium salt, in a suitable case, is placed near the part to be treated for a few minutes—say five to ten—at a time, and if the surface is too large for a single treatment, small areas are successively brought within the range of the bombarding rays. This process is repeated every few days. In this way satisfactory cures have been effected. When thus treated, improvement is noticed at once; the inflammation gradually dies away, and a healthy skin begins to form. The cures, up to the present, have every appearance of being complete, though years must elapse before they can be said, with absolute certainty, to be quite perfect.

As a further illustration of the beneficial effects that radium compounds may produce, a paper communicated by M. C. Phisalix to the Parisian Academy of Sciences is worth mentioning. M. Phisalix gives particulars which show that radium rays exercise an attenuating influence on snake poisons, the intensity of the effect produced being a function of the time.

We thus see that many benefits are being conferred on man, and most probably permanent benefits, as a result of radio-active investigations, helping him to

fight some of the most fearsome diseases—cancer, consumption, and lupus—with which humanity is afflicted.

Some of these radio-active substances—uranium, thorium, polonium, actinium, and radium—are more wonderful than any ever dreamt of by the most imaginative of the old alchemists. These substances, of whose existence we were in ignorance ten or twelve years ago, and whose properties and powers are far from being thoroughly known and investigated at the present time, are already encroaching on other domains of science, helping here, suggesting there, and in all cases inciting to further research.

These investigations appeal as much to the medical practitioner as to the chemist and physicist, to the spectroscopist as well as the botanist and geologist, to the man in the street as well as the astronomer. The imagination, let alone the reason, is appalled by the magnitude of the benefits which may arise—in fact, are arising—from the discoveries connected with radio-active bodies. Lupus is laid low, and many other microbes are in danger. Bacteriologists, chemists, physicists, in fact scientists generally, have been supplied with powerful weapons to assist them in conquering the unknown realms of science.

SCENES FROM THE ALCHEMISTS.

BY E. J. SUMNER, B.SC.,
Burnley Grammar School.

TO those who feel the desirability of introducing into their accounts of the history of science some elements of the "human interest" (if we may so call it), the following outline of an attempt to represent dramatically some scenes connected with the alchemists may not be unwelcome.

Of the five scenes presented, three were connected with the life and work of Geber, Roger Bacon, and Paracelsus, and in each case their ideas and phrases, as expressed in their written works, were freely drawn upon. One scene portrayed the legend of the automatic or talking head whose construction is attributed, amongst others, to Roger Bacon, whilst the last scene is an extract, slightly altered, from Chaucer's *Canon's Yeoman's Tale.*

The stage requirements are fairly simple, and will, of course, vary according to conditions of time and place. Suffice it to say that, by doubling the width of an ordinary lecture-room bench, surrounding it with curtains on which various weird-looking objects such as the skins of crows and lizards, drawings of the mystic pentagon containing the inevitable "Abracadabra" and of the signs and names of the seven metals, were fastened, and placing on the stage ancient-looking glassware, herbs, and old volumes, together with a venerable carved oak high-backed chair kindly lent by the neighbouring theatre, fairly effective stage surroundings were obtained. Gas being available, the necessary furnace was made by placing lumps of charcoal in a cylindrical fire-brick holder over the top of an ordinary muffle furnace, which concealed the bunsen burner used to start the combustion.

SCENE I.

GEBER, *seated at table, watching an experiment. Enter* Spanish Gentleman, *anxious to know if* G. *can transmute metals.*

S. G. Master! hast thou, as men say, the secret of the philosophic art?

Geber. Not yet have I attained it. Days and nights have I spent in dissolving, coagulating, amalgamating and distilling, but without that long-desired result. Nature spends thousands of years in making her metals; why then should we be discouraged if in our short span of life we have not yet learnt to imitate her processes?

S. G. Thou say'st truly, master; for who can tell what may be the influence of the stars on the metals while they are yet being made perfect in the earth?

Geber. It were absurd to think that nature in the earth bred gold perfect on the instant. Something went before. Nature doth first beget the imperfect, then proceeds she to the perfect.

In spite of all need we not despair. Can we not refine iron into copper, and copper to silver?

S. G. Canst thou, master?

Geber. Yea, verily. Give me thy dagger.

[GEBER *then plunges dagger into solution of copper sulphate, thus covering it in a few seconds with copper; also strip of bright copper into mercury chloride solution—giving silvery appearance on rubbing. A striking effect can be obtained by pouring sodium amalgam into saturated solution of ammonium chloride, giving thus the* appearance *of silver growing or developing from quicksilver.*

(*Curtain.*)

SCENE II.

THE TALKING HEAD.

(*A large mask in a corner of the room in addition to previous scene.*)

Enter ROGER BACON'S Assistant, *busily engages in straightening the disordered room, looking apprehensively from time to time at the head, and muttering his fears that his master is in league with the devil and that he will get into trouble with the superior of the order. Then as the head speaks,* "Time is," *and again,* "Time was," *in a sepulchral voice (boy under the stage), he determines to go at once and tell his master that the head has spoken. Just as he is about to pass it, however, the last phrase,* "Time is past," *is uttered, and, followed as it is immediately by an explosion (sulphur and potassium chlorate), and a blaze (a tube containing sulphuric acid being dexterously placed on a mixture of potassium chlorate and sugar), he falls insensible to the ground.*

(*Curtain.*)

SCENE III.

ROGER BACON IN HIS CELL.

ROGER BACON, *sitting at the table with lenses and other optical instruments round him. Enter* Holy Brother, *his friend, who thus:—*

H. B. I entreat thee once again, brother Roger, submit to the decrees of the order. Why should'st

thou prolong the strife to thine own hurt? Renounce thy magical arts and go free.

R. B. Magic have I none. The world is full of conjurors who deceive people by making them believe what does not exist. Ventriloquists imitate far-off sounds, and pretend to converse with spirits. Others by sleight-of-hand astonish fools.

Unfortunately man is always ready to believe the marvellous, and does not take the trouble to examine and question nature with the help of his reason.

[*Enters here the* Superior of the Order, *who thus*:—]

Again, magician, I adjure thee, forsake thy infernal arts and obey the commands of thy order. Burn thy books and instruments and thou shalt go forth free.

R. B. (*indicating the instruments and books surrounding him*). Because these things are above your comprehension you call them works of the devil.

You theologians regard them in your ignorance as if they were magical and unbecoming a Christian. I refuse to give them up.

[Superior *departs with trepidation, making sign of cross.*

(*Curtain.*)

SCENE IV.

PARACELSUS, *at the time when about to become Professor of Physic at Basle, in conversation with* FESTUS, *a friend, who seeks to restrain him. Scene as before.*

P. Have no care for my misery, friend. Let me bear my burden myself. I have two failings—my poverty and my piety.

My poverty was thrown in my face by a burgomaster who had perhaps only seen doctors attired in silken robes, never basking in tattered rags in the sunshine. So it was decreed I was no doctor.

For my piety I was arraigned by the priests, for I do not love those who preach what they do not practise.

F. Why wilt thou not stay here in safety, and work with me in peace?

P. Hear this, and fear not for me. Thus shall their blood be turned to water who dare oppose me.

[*Here drop of acid added to quantity of just alkaline phenol-phthalein solution—or other means of emphasising words.*

PARACELSUS *then reads from a manuscript the following introduction, sufficiently illustrative of his style*:—

Concerning the Tinctures of the Philosophers written against those sophists born since the Deluge.

From the middle of this age the monarchy of all the arts has been at length derived and conferred on me, Philippus Aureolus Theophrastus Bombastus van Hohenheim, Prince of Philosophy and Medicine. For this purpose I have been chosen by God to extinguish and blot out all the phantasies of elaborate and false works, of delusive and presumptuous words, be they the words of Aristotle, Galen, Avicenna, Mesva, or the dogmas of any among their followers. My theory, proceeding as it does from the light of Nature, can never, through its consistency, pass away or be changed; but in the fifty-eighth year after its millennium and a half it will then begin to flourish. The practice at the same time following on the theory will be proved by wonderful and incredible signs, so as to be open to mechanics and common people, and they will thoroughly understand how firm and immovable is that Paracelsic Art against the triflings of the sophists.

So, then, you wormy and lousy sophist, since you deem the monarch of Arcana a mere ignorant, fatuous, and prodigal quack, now, in this mid age, I determine in my present treatise to disclose the honourable course of procedure in these matters, the virtues and preparations of the celebrated Tincture of the Philosophers for the use and honour of all who love the Truth, and in order that all who despise the true arts may be reduced to poverty.

[*Excitedly declaiming the last sentence he throws down his manuscript, and curtain falls.*

SCENE V.

EXTRACT FROM "CANON'S YEOMAN'S TALE" (*Chaucer*).

Enter False Canon *and two* Priests (*his dupes*) *in room with furnace, bellows, etc.*

Canon. Bring hither now thy quicksilver, sir priest, and thou shalt it have made, into as good silver and as fine, as there is any, in your purse or mine.

[*Puts quicksilver in crucible on furnace and bids* Priest *blow the coals.* Canon *performs mystical signs and mutters incantations before the signs on the walls. Then turns to the* Priest.

Ye been right hoot, I see well how ye swete;
Have here a cloot, and wipe away the wet.

[*So saying he himself takes the bellows, and while blowing, takes piece of silver concealed in wax and drops it in the crucible. After blowing a while he empties crucible into a mould, then to* Priest:—

Look what there is, put in thine hand and grope
Thou findé shalt there silver, as I hope.

[*Then aside, as* priests *gaze astonished at the piece of silver taken out, passing it admiringly one to the other*:—

What, by our lady, should it ellis be?
Shaving of silver, silver is, parde!

(*Curtain.*)

From the above account it will be seen that the scenes can be rendered by three actors, one of whom at least must be able to declaim well and have the dramatic instinct, while as the minor personages have less to say, they should be able to put a considerable amount of facial and other expression into their "business."

The intervals necessary for changing costumes can be used for giving a little explanation of the ideas of the times, and the lives of the people represented, otherwise the mystery element of the interest will probably be too predominant.

Much care, of course, must be taken to arrange the illustrative experiments, explosion, flare-up, etc., so that there shall be no hitch; but if there is one, it is consolatory to remember that failures were not unknown to the alchemists.

THE EDITOR begs to announce that the award for the Prize Competition for July, together with the extract for the September competition, will both appear in our next issue.

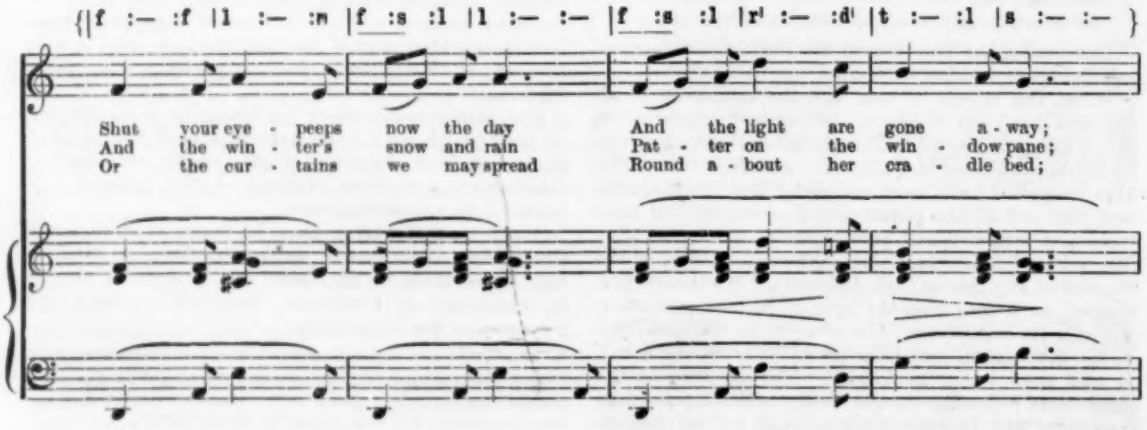
BABY DEAR, GOOD-NIGHT.

(DEDICATED TO "KIDDIE.")

Words by JANE TAYLOR. *Music by* THOS. J. HEWITT.

Dreamily. Doh is C.

p
1. Lit - tle ba - by, lay your head On your pret - ty cra - dle bed;
2. Yes, my dar - ling, well I know How the bit - ter wind doth blow,
3. For the win - dow shut - teth fast, Till the stor - my night is past,
p


Shut your eye - peeps now the day And the light are gone a - way;
And the win - ter's snow and rain Pat - ter on the win - dow pane;
Or the cur - tains we may spread Round a - bout her cra - dle bed;

poco rit.
All the clothes are tucked in tight— Lit - tle ba - by dear, good -
But they can - not come in here To my lit - tle ba - by
So till morn - ing shin - eth bright, Lit - tle ba - by dear, good -
poco rit.
1st and 2nd time.
3rd time.
night.
dear.
night.
pp cres.
dim. e rit.
ppp
Ped. * Ped. * Ped. *

OUR TUTORIAL SECTION

NEW SCHOLARSHIP COURSE FOR 1906-7.

BY ARTHUR T. FLUX,

Late Principal of the Belvedere Pupil Teacher Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

Work for the Month.

PART I.

1. Reading.—The regular daily oral practice must be systematically maintained, mere correctness being considered as the minimum aimed at, absolute excellence being always the objective. Experiment upon some willing friend, and see if you can interest and maintain the interest in passages which might be considered dry. The reading should not be limited to prose; verse affords excellent materials, the rhyme and rhythm adding to the value of what is read.

2. Recitation.—Learn the next twenty lines, aiming always at an excellent rendering of the author's meaning.

3. Penmanship.—Write a page daily in the *Practical Teacher Copy Book*, specially prepared for this examination, and use great care at all times. Always use the same pen and always keep to the same style and formation of the letters; constant change will ruin any unformed writing.

4. Composition.—The remarks on this subject in last month's issue have been taken to heart by some of my correspondents, but several express the feeling of hopelessness at ever improving. This should not be so. Excellence in composition is a matter of slow growth, but it is of steady and consistent growth if the practice be steadily maintained. All students must cultivate the habit of self-criticism, and, as criticism is largely a matter of comparison, there must be some standard by which to estimate the value. This standard can only be obtained by reading the best of English literature—carefully and thoughtfully. The chief defect noticed in the last few essays corrected is the lack of balance in the sentences; they are often correct in idea but badly expressed. Paraphrase is a good exercise to correct this defect, or rewriting the essay without consulting the first copy, or even by paraphrasing the first copy. Avoid any straining after effect by the introduction of unusual and archaic words. The use of the rhetorical question must be indulged in very sparingly. Send up your essays for criticism. If your text-book in English contains a collection of faulty sentences, study them carefully and correct them. The following are examples of what I mean:—

A nation has no right to violate the treaties they have made.

Shakespeare is greater than any dramatist.

I wish to cultivate a further acquaintance with you.

A man may see a metaphor or an allegory in a picture as well as read them in a book.

These flowers smell very sweetly.

I hope to regularly see you.

The murderer was hung this morning after partaking of a substantial breakfast.

Did you read about the enemy's capture.

The authorities would have liked to have seen the lady afterwards.

Write one or two essays each week, selecting from the following list. Read up your subject if necessary; sketch out a plan upon which you propose to write, and *always* revise carefully.

(*a*) One crowded hour of glorious life is worth an age without a name.

(*b*) Does brilliance or persistency succeed in the long run?

(*c*) Heroes and hero worship.

(*d*) Property has its duties as well as its rights.

(*e*) "To do a great right do a little wrong."

(*f*) Faces in a crowd.

(*g*) When in Rome do as Rome does.

(*h*) Trade follows the flag.

The following notes may be of assistance:—

(*a*) In writing an essay on a statement it is well to examine the truth first before adopting it as true. A taking phrase or clever epigram is often accepted as a statement of fact, when a little examination will expose its fallacies. Read Lamb's *Essays* on some of the common proverbs. In this instance it is well to ask, "Is it?" It depends entirely upon the point of view taken by the individual. "I should like," says a heroine in a novel, "to do some glorious deed, and think of it ever after." This is not a very high idea of life. Men and women have in the past, and will in the future, gain a place in history, and receive the world's acclamation, for some sudden deed of valour; but their lives may be useless compared with that of another who passes through life doing good quietly, unrecognised by the world in general, and whose only newspaper notice is a brief announcement (paid for) that life has departed. It is not every brave soldier that gets the V.C.; thousands merit it, but do not receive it—their deeds are unnoticed, for more courage and valour are required where a man has to carry out a perilous duty alone, unaided, and unseen than is needed for the sudden rush in the heat of action.

(*b*) This question assumes what we should not admit, viz. that men can be divided into two distinct classes—the brilliant and the persistent—when really this is no classification at all. If a man possesses brilliancy without persistency he will never succeed; and, on the other hand, a dull man of small intellect may be indomitably persevering and yet never attain success. Brilliancy must, to be useful, be accompanied by some amount of continuity of purpose, and plodding industry must have some amount of intellect to attain any eminence. Expand this, and, having made this reservation, estimate which of the two is more likely to make a name.

(*c*) If possible read Carlyle on this subject. What is a hero, and why is he worshipped? Bear in mind that the world's commendation or condemnation is no test. A man despised by one generation is worshipped by the next, and *vice versâ*. Think out what it really is that makes a man a hero to his acquaintances, or to a nation; you will find it a difficult problem. There was no greater hero in the nation's eyes at the close of the African War than Baden-Powell, and, although no one deserved the encomium of praise showered on him more, there were (as he would be the first to admit) dozens that did their duty equally well, but who were comparatively unnoticed.

(*d*) This statement is absolutely true—in any community. Robinson Crusoe on his island was free from it till he obtained possession of Friday, and so was Adam before the creation of Eve; but in all life, since the individual cannot stand alone, he must depend upon others and others must depend upon him. A man cannot morally do "what he likes with his own," although the opposite is often asserted. He may own a £500 motor-car; if he likes to take a hammer he can smash it to pieces. He is breaking no *law*, but he is reducing the wealth of the nation by the value of the car. Every farm added to an estate lays the owner under an obligation to do the best for it and the people living on it. The law has defined the "rights" and some of the duties, but many are left to the discretion of the individual.

(*e*) This is a topic which has been debated as long as men have argued about anything, and about which no decision can ever be arrived at. "Is it right to do evil that good may follow?" is a question that cannot be answered. What is "right"? what is "evil"? what is "good"? Every individual will give a different definition. It is only when the general statement is applied to particular cases that we can discuss it feeling sure of the ground. Lying is evil, but if a captive soldier by lying could save his fellows from destruction, would it not be justifi-

able? Stealing is evil, but if by stealing a revolver you could prevent a murder, would you not do it?

In writing an essay on any general statement of this kind you must always examine the terms and see that you understand exactly what is meant. A very simple word means a dozen things to a dozen different people. Every one you ask will unhesitatingly say that our English constitution needs "reform," but probably no two mean the same thing by it.

(*f*) "Faces are but a gallery of pictures where there is no love," said Bacon in one of his truest apothegms; but as much interest can be derived from the study of the faces one meets in a crowd as from the study of the pictures in a gallery, for the face is a living thing, and betrays by expression the character of the individual—in the majority of cases, but not in all, for some faces become, as the result of long practice, absolutely expressionless, and others are absolutely misleading. The stern face occasionally is accompanied by the kindest heart, and the air of benevolence may be a cloak for the greatest vice. But the speculations as to the character from the study of the face are always a source of amusement and interest.

(*g*) First define exactly what you understand by this statement, and expand it. In this you must be careful. It does not mean, "When you are in other countries adopt the dress and manners of the inhabitants," for that would mean "Be a cannibal" in some cases, or "Dispense with clothes" in others. The statement is much wider than its application is intended to be, and simply advises the adoption of such manners and customs in civilised countries as may avoid the appearance of singularity. The Englishman too frequently forgets what is due to the feelings of foreigners in their own country, and so gains an unenviable notoriety. A man, who in England would dress with care, sometimes goes to the opposite extreme abroad, and lounges about a cathedral in cycling suit and cap, and may even go so far as to smoke. Such instances are happily much rarer now than they used to be.

(*h*) The first ceremony on the acquisition of any new territory is the raising of the national flag, and, as in English history this has usually taken place in inhabited countries, it is only natural that the next step is the opening of trade with the natives. "As the Empire has increased so the trade has increased" is another way of putting the same statement. The truth of this is not difficult to prove. "Civilisation," some one has cynically remarked, "is the process of teaching people to want what they previously were quite happy without." The Maories of New Zealand have been educated up to store clothes—and consumption; the West African native to fire-arms, cheap gin—and drunkenness. In other cases the acquisition of territory has led to mutual exchange of useful commodities.

5. Arithmetic. Decimals.—Read up the theory of decimals in Christian and Collar. Note (1) a decimal is merely a particular case of vulgar fraction, where the denominator is 10, or some power of 10 not expressed.

(2) In multiplication arrange the working so that the exact value of each line is shown.

E.g. 23·25 × 1·225:—

23·25			23·25
1·225			1·225
11625	is a wrong	The correct one is	23·25
4650	arrangement.		4·650
4650			·4650
2325			·11625
28·48125			28·48125

(3) In the division of decimals great care must be taken to understand the position of the decimal point and the *exact* value of the remainder.

(4) In the application of decimal fractions to concrete quantities avoid reducing the decimals to vulgar fractions. *E.g.*—

·3125 of £1 = £·3125
20

6·2500 shillings
12

3·0000 pence = 6s. 3d.

(5) Work in decimals wherever you can. *E.g.* 2·35 of £5, 7s. 6d = 2·35 × 5·375.

Work the following sums:—

1. What is the difference between 22·4735 of £1 and 17·2845 of a guinea? Ans. £4, 6s. 5·946d.

2. Add ·275 of a bushel to ·725 of a quarter, and find the value of the whole at 13s. 4d. a bushel. Ans. £4, 1s. 0d.

3. A warehouse consists of seven floors, the rent of each floor is ·875 times that of the floor below, the rent of the fourth is £17, 3s. Compare the rents of the highest and lowest floors and find that of the lowest. Ans. $7^6 : 8^6$; £25, 12s. 0d.

4. Find the value of $\frac{·321 \times ·321 - ·179 \times ·179}{·321 - ·179}$ of £5.

Ans. £2, 10s. 0d.

(The fraction is of the form $\frac{a^2 - b^2}{a - b}$.

The answer to this division would be $a + b$. Hence = ·5 of £5.)

5. How many times can a cup containing ·013 of a pint be completely filled from a jug containing a quart, and how much (expressed as a decimal of a pint) will remain in the jug after the last complete filling of the cup? Ans. 153; ·011 pints.

6. The product of two numbers is ·15252. If we increase one of them by ·02 the product becomes ·1525446. Find the numbers.

7. Find the value of 1998 × £11·092 + 365 × 19s. 11·999d., working as shortly as you can. Ans. £548, 1s. 3·475d.

8. A small object weighs ·009 of an ounce. How many such objects would be required to turn the scale against a weight of 1 cwt. 1 qr. 1 lb., and by what weight would the mass of small objects exceed this weight? Ans. 225778; ·002 oz.

9. The fraction $\frac{1}{1\frac{1}{79}}$, is intermediate in value to two consecutive figures of ·1234. Find which are these figures, which of the two is nearer to $\frac{1}{1\frac{1}{79}}$, and by how much expressed decimally.

Ans. 3 and 4, 3, ·0026.

10. A man borrowed 34·95 francs from a money-lender, giving a written acknowledgment. The money-lender promised to charge no interest, but he afterwards scratched out the dot and put it between the 9 and the 5. The sum thus claimed was paid. Find the gain correct to the nearest penny in English money (£1 = 25 francs). Ans. £6, 12s. 5d.

11. Simplify $\left\{1 - \frac{1}{1 + \frac{1}{1 + \frac{1}{3\frac{1}{4}}}}\right\} \times \frac{2·3}{·017}$ Ans. 66⅔.

12. Divide the difference between the thousandth part of 375 and the hundredth part of 16 by the ten-thousandth part of 43.

Ans. 50.

13. What decimal of 13s. 4d. must be added to 1·3125 of £1 to make the total equal to ·5125 of £5? Ans. 1·875.

14. Find the value of 10·578 of 3s. 4d. + 8·337 of £1.

Ans. £10, 2s. 0d.

15. Find in the shortest way the value of (1761 + 5·28) yards. Give answer in miles and the decimal of a mile. Ans. 5·283.

16. Find in the simplest way you can the difference between £24, 17s. 4d. × 7·2 and £24, 17s. 3d. × 7·3. Ans. £2, 9s. 1·5d.

17. Divide a franc between A, B, and C so as to give A 20 centimes less than B and C together, and so as to give B 1·4 times as much as C. Show the reasoning fully.

18. A weight of 1 lb. is placed on one scale of a balance, and pins each weighing ·0013 of an ounce are put one by one on the other scale until the balance turns. Then one pin is taken out of the scale. How many pins are left, and by how much in ounces does the 1 lb. weight outweigh them? Ans. 12307; ·0009.

19. What decimal of a guinea is ·0129 of a pound?

How can one tell before working the above sum (*a*) whether the result is a terminating or a recurring decimal, and (*b*) whether ·0129 is right or wrong? Ans. ·0122.

20. What method do you employ for the division of decimals? How would you explain it to a class? Take as example 691·75 ÷ ·0013.

6. Drawing.—One or two freehand copies each week, together with a group of models. Students are requested to send up drawings for criticism. General directions are not of so much use as particular criticisms.

7. *Music.*—Staff Notation. Common musical terms.

A list of these terms will be found in any good text-book. Students should note carefully that the terms made be classified into those relating to pace, to execution, and to expression. The commonest mistakes are made in confusing such terms as Rallentando and Diminuendo—the former relates to pace alone, the latter to force.

The following terms have been asked for in various exams.:—

Crescendo, adagio, allegro, dal segno, pianissimo, rallentando, poco mosso, meno mosso, leggiero, maestoso, allegretto, dolce, a tempo, staccato, diminuendo, M 80, legato, mezzo forte, presto, sforzando, ad lib., forte, ritard, andante, syncopation, calando, stringendo, ben sostenuto, piu, sempre, scherzando, etc.

PART II.

1. *English Grammar and Literature.*—Work for the month.
   (*a*) Revise the grammar of the adjective.
   (*b*) Abbot and Seeley—Second Part, chapter i.
   (*c*) Read *As You Like It.*
   (*d*) Next twenty poems in Palgrave's *Golden Treasury.*
   (*e*) Read Conan Doyle's *White Company.*
   Edgar's *Cressy and Poitiers.*

Notes.—(*a*) The chief points in the grammar of the adjective are:—

(1) Exact definitions and classification of the various kinds.
(2) Comparison—regular and irregular.
(3) Adjectives that do not admit of comparison. These are qualifying words which from their nature cannot be compared, *e.g.* adjectives of definite quantity and demonstrative adjectives, and such adjectives of quality as express—
   (*a*) Nationality—French, German, Dutch.
   (*b*) Material—wooden, golden, earthen.
   (*c*) Definite shape—square, triangular, circular.
   (*d*) A quality existing only in one degree—supreme, excellent, etc.

(4) Distinguish also between the meanings of some double comparatives and superlatives, *e.g. elder* and *older, later* and *latter, further* and *farther*, and such demonstratives as *each* and *every, some* and *several*, etc.

(*b*) The chapter in Abbot and Seeley will bear reading several times. It is a close analysis of the spirit and style of what we call poetry, and should help the student enormously not only in appreciating really good poetry, but at the same time in detecting flaws and errors. The latter is never the main object of reading a passage, but it is a power which should be assiduously cultivated, for it helps in composition beyond all other things. If a student can readily detect weakness, coarseness, obscurity, etc., he is hardly likely to produce sentences containing the same fault. There are many who recognise no difference between poetry and prose, except that the former is printed in different style, and perhaps rhymes. As pointed out, the object of poetry is to give pleasure, and hence it starts from a different standpoint from prose, which is necessarily to instruct. What is inadmissible in the latter is quite permissible in the former. If the chapter is closely studied it cannot fail to improve any one's taste in reading and power in composition.

(*c*) *As You Like It* is a pastoral play redolent of the fields and woods, full of interesting and charming characters, and best seen when acted in the open air, under the branches of some spreading trees, with a natural background of woodland scenery. It is a change from the crowded court, the tented field, the madding crowd, a reversion to that primeval simplicity of life which we all yearn for and rarely adopt. In the Forest of Arden trouble and care, worry, vexation, ambition, disappointment, and despair, seem banished. "Hath not old custom made this life more sweet than that of painted pomp?" says the Duke.

> "This our life, exempt from public haunt,
> Finds tongues in trees, books in the running brooks,
> Sermons in stones, and good in everything.
> I would not change it."

And yet he does quite readily when the opportunity occurs, and speaks of the return to the crowded life as "Our returned fortune."

The chief interest in the play centres round Rosalind and her gentle cousin Celia. The former is a girl full of life and vivacity, and though she dons a boy's dress she is never anything but pure womanly. Celia is quieter, less self-reliant, but altogether charming. Touchstone is the best of Shakespeare's fools, and though fool by profession is far from foolish. His devotion to the girls leads him to leave a comfortable home for discomfort. "Now am I in Arden—the more fool I—when I was at home I was in a better place"; and yet we feel that he would do the like again, and that his clowning is assumed on many occasions to hide the promptings of a true and brave heart. Jaques is the philosopher who utters many wise speeches, and accepts his position with an indifference which is hardly natural. Even his friends do not quite understand him, and we, with them, cannot help thinking that he uses speech on many occasions to hide his thought—a worthy man, but a walk with Touchstone would be more enjoyable than one with Jaques. The wooing by Orlando, and the gentle assistance given by Rosalind, who nowhere loses the slightest part of her gentle womanhood, forms an amusing contrast with Touchstone's directness and Audrey's simplicity. The whole play is charming, and will be read with pleasure by any one who has the slightest imagination and appreciation of romance.

(*e*) The book selected for the month gives excellent pictures of the times of Edward III. The *White Company*, although it deals with the later part of the reign, gives an excellent picture of mediæval life. The peaceful existence in the convent is in sharp contrast to the wild life without, the scene at the inn is equal to anything in *The Cloister and the Hearth*, the slumbering discontent of the serfs—to break in open rebellion in the next reign—is skilfully shown. The methods of fighting, the arms and equipment of soldiers, the conduct of a tournament, the Jacquerie and the ill-fated expedition to Spain, all provide much food for thought.

2. *History.*—For this month prepare the reigns of Edward I., Edward II., Edward III., and Richard II.

Notes.—The policy of Edward I. was mainly conceived with two objects—
   (*a*) To reform the law and place legal administration on a proper basis.
   (*b*) To secure one sovereignty over the whole of the island.

In connection with (*a*) a remarkable series of laws were passed—

1275. 1st Statute of Westminster. A summary of previous laws, provision for freedom of election, and fixing amount of feudal aids.
1278. Quo Warranto. Writs issued as to the rights of barons to the lands they possessed.
1279. Mortmain or De Religiosis. Preventing the alienation of land to the Church, to the diminution of the king's power and income.
1285. 2nd Statute of Westminster (De Donis). Instituting the law of entail and establishing Nisi Prius Justia.
   2nd Statute of Winchester. Making provision for protection by police, etc.
   Circumspicte Agatis. Limiting the jurisdiction of the Clerical Courts to spiritual matters only.
1290. Quia Emptores. Facilitating transfer of lands and preventing subinfeudation.
1297. De Tallagio. Establishing the principle of no taxation without the consent of Parliament.

The Law Courts were, as we have seen, divided, and each provided with a separate number of judges. These reforms have caused Edward to be called the English Justinian, after the Roman emperor of that name who codified the Roman law.

In connection with (*b*), the refusal of Llewelyn ap Griffyd to present himself for homage led to the Welsh campaign and the incorporation of Wales. The Statute of Wales, 1284, introduced English law into that country.

The disputed Scotch succession gave Edward the opportunity he desired of extending his power northwards. On the death of the Maid of Norway in 1290 the descendants of William the Lion became extinct, and the succession went to those of David, Earl of Huntingdon, his brother. Of the many claimants, only two need be considered—John Balliol, the grandson of David's elder daughter Margaret, and Robert Bruce, the son of the younger daughter Isabella. The point at issue was this: "Should primogeniture or proximity of degree be followed?" Bruce was a degree nearer through the second daughter. On the matter being referred to Edward he first exacted the recognition of himself as overlord of Scotland, and then decided rightly in favour of Balliol. Edward purposely used his position to force Balliol to become "contumacious," and thereupon declared his fiefs to be forfeited, and war ensued. The conduct of the war must be carefully read.

Edward II.—The whole of this reign presents a picture of what takes place under a weak king. In the early years, disputes with the baronage led to the appointment of the Lords Ordainers, a council of twenty-one, to govern the realm. Edward's self-indulgence and weakness for favourites led to the loss of Scotland (a plan of Bannockburn must be learnt), and ultimately to his deposition and death.

Edward III.—The chief interest under this king is the commencement of the Hundred Years' War with France, and of a feud between the two countries which has hardly yet died out.

The causes of this war must be clearly understood—
(1) The French had assisted the Scots in their struggle for independence.
(2) Philip VI. attempted to seize Aquitaine, a province held by the English king as a fief.
(3) The raids of the French on the south coast of England.
(4) The rising in Flanders.

The last is the real cause. The great towns of Flanders (Belgium) were employed in the manufacture of Flemish cloth.

and for this purpose bought all the surplus English wool—the staple trade. They had risen in revolt against the Count of Flanders, who, unable to suppress the movement, had called in the aid of the French king. Had French influence become predominant the English trade must have suffered, and Edward supported the Flemish towns. The claim to the French crown was *not* the cause, for it was not put forward till after the commencement of hostilities, and then, at first, to secure the co-operation of some of the discontented French nobles.

The course of the war must be followed, and the battles of Cressy and Poitiers studied with a plan. The distance from England, the difficulties of transport and maintenance, rendered it impossible to keep up a large army in France, and the attempt to annex the crown was bound to end in failure.

The Black Death, Statute of Labourers, Statute of Treason, of Præmunire, and the troubles at the end of the reign must receive attention. In the case of Treason it must be noted that when a man was condemned for treason, his estates reverted to the Crown. Hence it was to the king's interest to make the term as wide as possible in its application and to the barons' to limit it.

Richard II.—The Peasants' Revolt and the social circumstances which produced it must be very carefully studied. The causes were of long duration; an insult to a peasant's daughter was far too common to cause thousands of men to risk their necks in rebellion, although it was the spark that caused the conflagration. The causes were:—

(1) The system of villenage, by which the Anglo-Saxon labourer was reduced to the position of a slave—a position most abhorrent to the Saxon character.

(2) The Black Death and Statute of Labourers, which fixed wages and conditions of service.

(3) The loss of the French provinces and the return of discharged soldiers.

(4) The heavy taxation, culminating in the unjust Poll Tax.

(5) The vague socialism spread abroad by Wycliffe's Poor Preachers.

The demands were:—

(*a*) Abolition of Villenage; (*b*) Land to be let at 4d. per acre; (*c*) Abolition of excessive market dues.

(*a*) Was never formally abolished, but the system received its death-blow; (*b*) Demanded a change in land-tenure—money payment instead of personal service—this speedily followed; (*c*) Was directed against the monopoly of trade by lords of the manor. To sell the produce of his land a man was charged such heavy dues that no profit to himself remained.

The subsequent misrule of the king, the Lords Appellant, the growth of Lollardism, and the downfall of the king, must be read up.

Citizenship.—Prepare chaps. ii., iii., and iv. The Crown. Parliament. The House of Lords.

3. *Geography.*—Work for the month:—

(1) Internal heat of the earth. Volcanoes and earthquakes and kindred phenomena.

(2) Prepare in detail Spain and Portugal, and learn a sketch map.

(3) Revise India.

Notes.—(1) The theory of volcanoes and earthquakes will be found in any text-book on physical geography.

(2) The chief points to be considered in the Iberian Peninsula are the productions, imports and exports, social condition, industries, towns and government.

(3) The study of India will demand much time and thought. It is difficult to appreciate at first the vast size and the enormous population, and still more to understand clearly that it is in itself an empire—an aggregation of different states and peoples, speaking different languages and professing different religions. The most interesting part of the geography is to trace the benefits that have accrued from the British occupation. Whereas previously there was continual warfare, to the neglect of industries, there has been since 1858 a Pax Britannica, and the Imperial Government has devoted itself not to exploiting the country for its own benefit, but to developing trade and commerce and education. Roads, railways, irrigation canals, lighthouses, harbours have been constructed; famine has been driven farther and farther off; laws have been administered with absolute fairness; and under the rule, kind yet adamant, the country has developed wonderfully. Many new industries have sprung up, old ones have revived, and although India is perhaps yet the poorest country on earth, it is nevertheless in a much more prosperous condition than ever before in its history.

The questions to be found in *Test Questions in Geography* (Meiklejohn and Holden) will show the scope to which it is advisable to read.

4. *Elementary Science*:—

Heat.—Effects of heat on gases, liquids, and solids. Expansion. Change of state. The Thermometer. Melting-points, boiling-points, and vapour.

Read up this section in the text-book; work all the exercises you can, and write for assistance in any difficulty.

5. *Elementary Mathematics*:—

(*a*) *Arithmetic.*—Compound proportion. Work as many examples as you can in Christian and Collar.

(*b*) *Algebra.*—Multiplication.

(*c*) *Geometry.*—Construction of parallels and angles.

(*d*) *Euclid.*—Propositions 18, 19, 26–30, with two or three deductions each week.

Test Questions on Last Month's Work.

1. Write as specimens of copy setting:—
   (*a*) Large hand.—Bibliographical.
   (*b*) Small hand.—Benares is a sacred city to the Hindu.

2. Work the following:—

(1) Divide £648, 16s. 11½d. amongst A, B, and C so that $\frac{1}{17}$ of A's = $\frac{1}{13}$ of B's = $\frac{1}{8}$ of C's portion.

Ans. £169, 13s. 11½d.; £219, 12s. 2½d.; £259, 10s. 9½d.

(2) What number is that which when divided by 34 leaves 2 remainder, while its double divided by 86 leaves 4 remainder?

Ans. 1464.

(3) Simplify $\frac{3\frac{1}{11} - 2\frac{2}{5}}{3\frac{1}{11} \times 2\frac{2}{5}} + \frac{3\frac{1}{11} \div 2\frac{2}{5}}{3\frac{1}{11} \text{ of } 2\frac{2}{5}}$. Ans. $\frac{4429}{17640}$.

(4) In a crowd $\frac{1}{3}$ of my money is stolen, $\frac{1}{4}$ of this I recover and lose $\frac{1}{5}$ of what remains. Having received £10, which increased by $\frac{1}{11}$ the money I then had, I paid away $\frac{3}{4}$ and received back $\frac{1}{7}$ of the bill as discount. What sum remained?

Ans. £20.

3. Distinguish between Gerunds and Participles, giving examples of each. What are the uses of the Infinitive Mood?

4. Compare the characters of Cassius and Brutus.

5. Show how a knowledge of etymology assists in understanding the exact meaning of a word. Illustrate your answer by examples.

6. Write a short essay on the state of England during Richard's absence.

7. Point out the importance of Henry II.'s legal reforms.

8. Write a short history of events in Normandy from the Conquest till the end of John's reign.

9. Why is Magna Charta called the foundation-stone of English liberty?

10. Draw from memory a sketch map of Germany; insert the chief rivers, the chief ports, and Bonn, Dresden, Munich, Strasbourg, Coblentz, Frankfort, Hanover, Potsdam.

11. Write a brief description of the Solar System.

12. How would you find the specific gravity of (*a*) a solid, (*b*) a liquid, (*c*) a powder, (*d*) a solid soluble in water?

All students are invited to write for assistance on any matter connected with this Course. Letters should be sent to Mr. A. T. FLUX, Belvedere, Kent, and must contain the coupon of the current number of the paper, with a stamped addressed envelope if a reply is needed by post.

The Scene of Gray's "Elegy."—Stoke Poges has been a good deal to the front lately in consequence of Stoke Park being advertised for sale. According to an article in the current *Home Counties Magazine*, by Mr. Howard Hensman, Stoke Poges is one of the few spots round London that have not suffered by the march of time. It is, indeed, remarkable how the old churchyard still retains every feature recorded in Gray's immortal *Elegy*. "The ivy-mantled tower" remains, and has so far escaped the vandal hand of the restorer. Its tenant, "the moping owl," was heard no longer ago than last summer, and the "rugged elms, the yew tree's shade," are still to be seen.

True to his belief that there was no advantage in having his monument within the church,

> "Where through the long-drawn aisle and fretted vault
> The pealing anthem swells the note of praise,"

the poet's own grave is marked by a simple tomb in the churchyard.

OUR CERTIFICATE COURSE FOR 1907.

BY GEORGE COLLAR, B.A., B.SC.,

Head-Master of Stockwell Pupil-Teacher School.

Test Questions on Last Month's Work.

PRINCIPLES OF EDUCATION.

1. In what ways is the discipline of a school affected by the planning and arrangement of the school building?
2. Indicate means by which teachers and parents can co-operate in the moral training of children.
3. State some of the most important principles that should guide you in drawing up a school time-table.

ENGLISH LITERATURE.

1. To what grades of society do the characters of the *Midsummer Night's Dream* belong, and how are they brought into relation?
2. Sketch the characters of *Dr. Primrose*, *Mrs. Primrose*, and *Moses*.

ENGLISH HISTORY.

1. What is meant by the "Heptarchy"? Say what you can of the different Teutonic kingdoms in this island previous to the year 800 A.D.
2. Describe the methods of making laws and administering justice among the Anglo-Saxons.
3. Write an account of three of the following:—Boadicea, Dunstan, Edgar the Peaceable, Canute, Godwin.

GEOGRAPHY.

1. What do you understand by "Latitude"? How can you determine the latitude of a place?
2. What records could you make in a class-room to show that the sun's apparent position in the sky changes from day to day?

ARITHMETIC.

1. Compare the different ways of teaching subtraction.
2. Explain, as to a class, the method of dividing by 63, using factors, showing clearly how the final remainder is obtained.

GEOMETRY.

1. Draw a triangle having a right angle contained by sides 3 inches and 1¼ inch in length, and measure the length of the third side. Tell as nearly as you can with the protractor the magnitude of the other angles.
2. Draw a triangle whose sides are 1½, 2½, and 3½ inches in length. Why could you not draw one whose sides are 1, 2, and 3 inches?

ELEMENTARY SCIENCE.

1. Describe a method of approximately determining the relation between the area of a circle and the square on its radius.
2. How can you tell the area of a triangle from the length of its three sides?

Notes and Syllabus for August.

ENGLISH LANGUAGE AND COMPOSITION.

Prepare chapters iii., iv., and v. of the *Art of Writing English*, or chapters iii. and iv. of Nesfield's *Senior Composition*. Work all the exercises at the end of the chapters.

Prepare essays on the following subjects:—
1. The best ways of spending holidays.
2. The life of Nelson.
3. The teaching of English Literature in Elementary Schools.

PRINCIPLES OF EDUCATION.

Study carefully chapters v. and vi. in the text-book.

The general principles set out in chapter v. are of great importance, and they require a very careful study, otherwise there is a risk of the statements degenerating into formulæ which may be applied in quite a wrong spirit.

The two-column arrangement of notes of lessons is open to a great deal of misuse, and is giving way to what is generally called the "five-point system." This system is based down in the observations made by Herbart and other psychologists on the steps by which new knowledge is acquired. These steps can be seen in the notes of lessons on Domestic Science, and others that are given from time to time in our columns. The first point is the *preparation*, and in this the teacher recalls to the children's minds such of their past experiences as will best enable them to grasp the new matter to be imparted. A knowledge of the way in which new matter is seized upon by, and amalgamated with, what is already in the mind is of the highest importance to teachers. As space forbids us to attempt to discuss it fully here, we must refer the student to the chapter on *Apperception* in Dexter and Garlick's *Psychology in the Schoolroom*.

The next step is the *presentation*, and in this the teacher endeavours, in accordance with the principles laid down in chapter v., to impart the new ideas to the children. Great care is necessary to insure that the children really gain ideas and not merely empty words.

Having imparted correct ideas to the pupils, the teacher's next care is to show them how to express those ideas in the most appropriate language—to give a neat definition of the thing they have been studying.

This step is called *formulation*, and corresponds to the blackboard sketch, which is frequently given at the end of notes of lessons arranged in two columns.

The best way to remember a thing is to associate it in the mind with something else. This is recognised by all who try to cultivate the memory. But if the association is to be effective there should be an analogy or resemblance between the associated things. Thus some people tie a knot in their handkerchiefs as an aid to the memory. But the knot simply reminds them that they had *something* to remember, but not what it was. The skilful teacher will, however, find analogous things with which to associate the subject of his lesson. Thus the object of the fourth point—*association*—is to fix the matter in the pupils' minds, and to enable it to be readily recalled.

Lastly, the lesson must have an "*Application*." Children delight in doing exercises, and an exercise is necessary in order to clench the nail of knowledge which has been driven home by the four previous blows. In this section there is, of course, room for great variety: in an arithmetic lesson the working of sums forms one of the best applications; in grammar the exercise may take the form of parsing and analysis, or of picking out parts of speech from a passage in a reading-book; in an object-lesson the application may take the form of a composition exercise. In this case the application may often be considered as a separate lesson, following the object-lesson; and in the case of a Scripture lesson, or a lesson on morals, a great deal of the application falls outside the supervision of the teacher; but he may rest assured that, in this case more than in any other, if there is no application the lesson has been thrown away.

ENGLISH LANGUAGE AND LITERATURE.

As this month is the holiday month, the student cannot do better than read through all the books set down for general reading. This will form a very agreeable holiday exercise, and will enable the student to obtain a good general idea of the plots and characters, which will be of great use on the second reading. We have generally recommended small editions, which can easily be taken into the country or down to the seaside, and slipped into the pocket.

Study in detail the first act of *A Midsummer Night's Dream*.

Scene i. line 17.—There are several accounts of Hippolyta, Queen of the Amazons. According to one, she was killed by Hercules and never went to Athens, and according to others it was her sister Antiope who married Theseus.

(20) *Duke.*—This word is from the Latin *dux*, a leader. The office of leading an army came in time to confer nobility, and in the English peerage the dukes represent the highest order. The title was not used in Athens, and Shakespeare has been criticised for using it in this play, but in so doing he merely followed North's translation of Plutarch, from which he drew his subject-matter.

(33) *Gawds*, from Latin *gaudere*, to rejoice, some trifle that gives pleasure. The noun is practically obsolete, but we use the adjective "gaudy."

(33) *Conceits*, little fancy verses of poetry.

(71) *Mew'd*, caged up. Originally the "mews" were the cages in which the hawks and falcons were confined while they were moulting—the word itself being from the Latin *mutare*, to change. As these cages were frequently kept in the royal stable-yards, the name is now applied to a set of stables.

(78) *Single blessedness*, now quite a common phrase to denote the unmarried state.

(89) *Diana.*—She was known to the Greeks as "Artemis." She was the patroness of virgins and of the chase.

(116) *Schooling.*—The word school is derived from a Greek word meaning leisure, hence *schooling*=instruction that can be given at our leisure.

(120) *Extenuate*, from Latin *tenuis*, thin; to draw out so thin that its strength has gone.

(134) Now quite a proverb; a list of such should be drawn up in the note-book.

(137) *Misgraffed.*—This is a better form than *misgrafted*, as the *t* was not in the original root, which is Old French *graffe*, from Latin *graphium*, a kind of lead-pencil, which the pointed stick set in the stock resembles in form.

(145) *Collied*, darkened.

(146) *Spleen*, anger; the different passions were supposed to reside in the different internal organs.

(173) *Carthage queen.*—Dido, queen of Carthage, burnt herself to death when she was forsaken by Æneas, whom she greatly loved.

(241) *Eyne*, the old plural of "eye."

Scene II.—Notice the great difference in style when the "rude mechanicals" are on the scene.

Line 2.—Anxious to use a long word, Bottom says "generally," which is just the opposite of "particularly" or "individually," the word he meant. The other mistakes that Bottom makes are of the same type—*e.g.* "grow to a point," "I will condole," "a monstrous little voice," "I will roar you as gently as any sucking dove," "we may rehearse more obscenely and courageously." The last phrase but one is frequently used in speaking of a person who, after leading people to suppose that he was going to make a great attack, has only a few quiet remarks to make.

(32) *Rarely*, not in the sense of seldom, but in a "rare good style."

(38) *Phibbus, i.e.* Phœbus, the sun-god.

(51) In Shakespeare's time female characters were generally taken by boys, who, of course, became unfit when their voices broke and the hair began to grow on their faces.

(109) *Properties*, the articles, or imitation articles, used on the stage.

English.

The student of English History must make himself familiar with movements that were going on in other parts of the world if he would read aright the history of his own country. One movement that was of very far-reaching influence was the rise of the Roman Catholic Church. The Church taught that the future world presented far greater differences of happiness and misery than had ever occurred to the minds of the ancients, and, moreover, claimed that out of the Church there was no salvation. In this way they acquired a great influence over individuals, which led to the formation of the most powerful and the best organised corporate bodies the world has ever seen. Under the Roman Empire the Church had but little power. In heathen times the Christians were persecuted, and under Christian emperors the Church received very powerful support from the State. But when the Roman Empire had been overthrown by Germanic invaders, and more particularly when the Germanic states came to be weakened by subdivision, then the Church seized its opportunity to become independent of, and then superior to, the State. Odoacer was so powerful a monarch that he was able to overthrow the last of the Emperors of the West; but a Church Council at Rome in 502 boldly declared one of his decrees void on the ground that no layman had a right to interfere with the affairs of the Church. Owing to the great difficulty in distinguishing *sacred* from *secular* things the Church was able to extend its influence by claiming to control marriage obligations, administration of wills, education, and the administration of justice.

In the first four centuries the see of Rome had no precedence over the others, and the struggle for supremacy dates only from the time of Leo the Great (440–461). Under his influence the Emperor Valentinian III. issued a decree declaring that the power of the Bishop of Rome was supreme, and giving as reasons that he was successor to St. Peter, the chief of the Apostles, and that Rome was the chief city of the world. He commanded all bishops in his empire to receive as law all that was sanctioned by the Bishop of Rome. Six years later the Council of Chalcedon voted powers to the Bishop of Constantinople which made him the equal of the Bishop of Rome. This was the first real step in the separation of the Eastern and Western Churches. When the Ostrogoths under Theodoric, and later on the Lombards, invaded Italy, the Pope succeeded in acquiring the leadership of Italy. Gregory the Great was a very able statesman, as well as a divine, and by his government of Rome did much to establish the temporal power.

Another important step was taken by the alliance between Leo III. and Charlemagne. Leo crowned his ally as "Emperor of the Romans," thus founding the "Holy Roman Empire," which existed, at least in name, until recent times. Although the Church gained much liberty and power under Charlemagne and his successors, yet the superiority of the temporal authority over the spiritual was unquestionable.

"The great change in the relations between the temporal sovereigns and the Popes, which was effected during the eleventh century, was mainly due to the genius and energy of a single great man—of Hildebrand—who directed the Papal councils during the Pontificates of Stephen IX., Nicholas II., and Alexander II., and became Pope in 1073, with the title of Gregory VII. Hildebrand resolved that the elections to the Papacy should no longer be dependent on the emperors, but should be conducted by the clergy of Rome alone. He accomplished this great revolution; but it was far from being the limit of the designs which he formed, and which his successors zealously adopted. Hildebrand determined to make the sovereigns of Europe abandon all interference with the elections of bishops and other Church dignitaries. So far, he might appear to be acting only for the protection of the clerical order. But he went much further. He formed and maintained the daring and specious scheme of establishing the universal supremacy of the Pope over all temporal authorities, and of making emperors, kings, dukes, counts, barons, senators and chiefs, whatever their rank or nation, admit the Pope's right to interfere in State affairs, whenever he saw grievous wrong in the dealings of State with State, or in the internal government of a single State, or even in the private conduct of individual rulers. Hildebrand, though not yet nominally Pope, was the practical chief of the Romish Church at the time when Duke William of Normandy planned the conquest of England."

Creasy's *History of England.*

The boldest step of all in advancing Papal claims was on the death of the Emperor Henry VI. in 1202. His rightful heir was but a little boy, and this led to a dispute for the succession to the kingdoms of Naples and Sicily. The Pope then declared that no election of an emperor was valid without his confirmation, and that in the event of a doubtful election the decision was to rest with the Pope. This same Pope—Innocent III.—made our King John grovel before him, and promise to hold his kingdom as the Pope's vassal. Peter II. of Arragon similarly received his crown as a vassal from Innocent III., and took an oath of allegiance to the see of Rome.

Geography.

Study the question of the construction of maps. The difficulty arises from having to represent a curved surface on a flat one. If the area is small, *e.g.* a town or county, the error is imperceptible; but if the area is large, it is impossible to show the places in their true position. The question is best understood by assuming that the globe is transparent, and that the lines on it are thrown as shadows on to the surface, which may provisionally be rolled into a cylinder or a cone. Hence the methods are called projections, and the most common are Mercator's, the orthographical and globular, and the conic projection. Of these Mercator's has the advantage that straight lines drawn between two places on the map represent in all cases the shortest distance between the two places on the surface of the globe; but this is achieved at the expense of

very great enlargement of areas in the high latitudes. The conical projection is a true projection, and for limited areas not in extreme latitudes gives very faithful results.

Another difficulty arises from the necessity of representing the vertical configuration. The two chief means of doing this are by "contour lines" and "hachures." Contour lines are lines drawn to divide land above a certain elevation from land below it. These may be drawn at any convenient intervals, 100, 200, 300, etc., feet, or at every 1000 feet. These lines give us no information about the height of the land between two successive contour lines, except that it lies between the two limits; thus the rise might be uniform or it might have nearly all the rise near one of the two lines. Hachures, on the other hand, give no indication of the actual elevation, but are drawn more or less closely together to indicate whether the slope of the country is more or less steep. This can be inferred in a general way from contour lines, for if the lines are close together the general rise must be much more rapid than if they are far apart.

Of course special maps may be used to show the geological formation of the country, and to give such special information as the situation and size of forests and cultivated districts, the rainfall and temperature, and the density of population.

Arithmetic.

For this month go to the end of chapter xvii. The last of these chapters is very important in itself, and still more important from the power it will give the student in dealing with the subject generally.

The tests of divisibility must not only be learned by the way in which they are established, they should be studied as methods of proving rules in arithmetic. The method of proving sums by casting out the nines is a very useful means of checking, not only set examples in arithmetic, but the totals of registers and such calculations as that.

Algebra.

Read carefully through the first three chapters of the *New Algebra*. It is essential that the student should grasp the fundamental ideas of algebra and the relation of the subject to arithmetic. Thus we see that algebra is "generalised arithmetic," and those principles and processes which have only a limited application in arithmetic can be applied without limit in algebra. The points which meet the student first are—(i) the use of negative numbers, or numbers below 0, and the possibility of operating with them in exactly the same way as with other numbers; (ii) the use of symbols to represent numbers in general; and (iii) the use of symbols to represent unknown numbers as a preliminary step towards finding their values. Work all the examples.

Geometry.

Division of straight lines into a given number of equal parts. Construction of a triangle equal in area to a given polygon. The latter problem depends upon the theorem that triangles on the same base and between the same parallels are equal. If therefore an angular point of a polygon be joined to the point which lies next but one to it, and a line be drawn through the intermediate angle parallel to this so as to cut one of the other sides produced, a polygon will be formed equal in area to the original one but having one fewer sides. By continually repeating the process the number of sides can be reduced right down to three.

Elementary Science.

Forms of Matter.—Most of our readers know that matter is that which occupies space, and that it can exist in three states—solid, liquid, and gaseous. They would, moreover, have no hesitation in saying that a piece of coal was a solid, water a liquid, and air a gas; but it is doubtful whether they could give a satisfactory definition of the three states. Yet this is necessary, for "science" means exact knowledge, and indefinite knowledge is always a source of danger. On examining different samples of matter we find that those that we call *solids* are those that retain their form without the help of external pressure. A liquid and a gas take the form of the vessel in which they are placed, and will *flow* from one vessel to another; hence liquids and gases are both called fluids. But they differ one from another in that liquids can only alter their volume to a very slight extent under the influence of pressure, while gases are readily compressible. Moreover, the vessel containing a gas must completely surround it, while a liquid may be kept in an open vessel.

The extent to which a gas may be compressed depends upon the pressure that is put upon it. The exact relation was discovered simultaneously by Robert Boyle in England and by Edmé Mariotte in France. Hence the law is called in England *Boyle's Law*, but in France it is known as *la loi de Mariotte*.

This law tells us that "*if the temperature of a gas remains constant its volume is inversely proportional to the pressure to which it is exposed.*" The apparatus required to illustrate this law is very simple: two pieces of straight glass tubing may be taken, each about 2 feet long, and united by a piece of india-rubber tubing, also about 2 feet long. The end of one of the pieces of glass tubing is closed, and a certain amount of mercury is poured into the open end of the other. On placing the two tubes side by side and adjusting their position, the surface of the mercury in the two tubes may be brought to the same level. The pressure of the air in the closed tube is now equal to that of the atmosphere. What this is exactly may be found by consulting the barometer. Let us suppose that it is 29 inches. The length of the column of air in the closed tube should now be measured; suppose it is 5 inches. The open tube may now be raised until the level of the mercury in it is, say, 4 inches above that in the closed tube; the pressure on the latter will then be 29+4 inches, and on measuring the volume, it will be found to be reduced to $\frac{4}{5}$ of 5 inches. If we assume that the bore of the tube is uniform, the volume will be proportional to the length. Raise the open tube again, say, until the mercury stands 8 inches higher than in the closed tube. The volume of the enclosed air will then be found to be reduced to $\frac{4}{5}$ of 5 inches; *i.e.* the pressure being $\frac{4}{5}$ of the original pressure, the volume becomes $\frac{4}{5}$ of the original volume.

Boyle not only discovered the law which bears his name, but made many other scientific discoveries. Owing, however, to his firm belief in an erroneous theory of combustion, he was unable to arrive at the correct interpretation of experiments he performed by heating metals in air, and showing that they increased in weight, whilst many substances on being heated in air lost weight and appeared to be consumed or annihilated. The researches of other chemists have proved that matter is not annihilated in any of those cases in which it disappears. On the other hand, the most careful experiments with the balance go to show that the total weight of matter at the end of the change is the same as that at the beginning, and that although matter may change its form and may enter into new combinations, it cannot be destroyed. Neither can new matter be created, although new bodies may be built up from pre-existing matter. This statement is generally known as the *Law of Conservation of Matter*, and is of vast importance in the study of science. Like certain other general statements in science, it admits of no absolute proof, but the attempt to disprove it by an example always fails. Numerous illustrations may be given in support of the law, but the student must remember that they are *illustrations*, and no one of them by itself is a *proof*.

(i.) The disappearance of water which is left exposed to the air, is accounted for by showing that it has simply changed into the gaseous state, and can again be recovered in the liquid condition.

(ii.) The apparent destruction of matter by burning may be shown to be merely a change in which new products are formed which in the ordinary course pass away in the gaseous form. A simple piece of apparatus is described in the text-book in which these products are collected. They consist chiefly of water—produced by the union of the hydrogen in the burning candle with oxygen from the air—and carbon dioxide, produced by the union of carbon in the candle with atmospheric oxygen. The former is absorbed by calcium chloride and the latter by caustic potash, and the weight, instead of undergoing a decrease, actually increases. Of course the increase represents the weight of oxygen supplied by the air.

(iii.) If chalk be strongly heated it is found to lose in weight, but if the heating takes place in a closed apparatus, it is found that a gas—carbon dioxide—is given off, and that the weight of this gas is exactly equal to the loss of weight which the chalk undergoes.

OUR SCIENCE SECTION

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MATHEMATICS.

(STAGES 2 AND 3.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mathematics, etc., Morley College; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

In this series of "Notes" it is proposed to give some assistance to those who are preparing for the examinations of the Board of Education in Stages 2 and 3 of Mathematics.

It will not be either necessary or desirable to insert matter which may be easily obtained from any text-book on the subject, but instead to give from time to time suggestions as to the portions of the subject which should receive especial attention, and, in addition, to supply hints or proofs where necessary of important formulæ.

A prominent feature will be made of typical questions worked out in full; these will usually be selected from recent examination papers. In addition, questions from the same source, bearing on the portion of the subject to which the attention of the reader is being directed, will be given; the answers to these will be inserted in the majority of cases.

It will not be possible in the brief space at disposal to anticipate all the difficulties that may be met with in reading the subject, but any further help that may be necessary can be obtained on application to the Editor.

Simplifications, Square Root.—In simplifying algebraic expressions, it is necessary to be familiar with simple algebraical expressions and identities—thus the square of $(a+b)$ or of $(a+b+c+d)$ could be obtained by the ordinary process of multiplication. But this is not enough; it is necessary to be able to write down the square or cube of such an expression without having recourse to multiplication; for this purpose it is necessary to observe the cyclical arrangement of the letters. Thus

$$(a+b+c+d)^2=a^2+b^2+c^2+d^2+2ab+2ac+2ad+2bc+2bd+2cd.$$

In a similar manner expressions such as $x^2-y^2=(x-y)(x+y)$ are important; finally, it should be noted that familiarity with factors of at least simple forms, such as $x^2-8x+15=(x-3)(x-5)$ $x^2+2x-15=(x-3)(x+5)$ and $x^2-2x-15=(x+3)(x-5)$ is very essential; when these are known, the roots of a quadratic can, in many cases, be written down by inspection. The following exercises will show some of the methods that may be used in certain cases:—

Ex. 1. (*a*) If $\frac{a}{b+c}=\frac{b}{c+a}$, show that either $a=b$ or $a+b+c=0$.

(*b*) If $a^3-b^3+ab(a-b)=m(a^2-b^2)$, show that either

$$a=\pm b \text{ or } a=m-b. \qquad (1906)$$

(*a*) Clearing fractions we obtain

$$a(c+a)=b(b+c).$$

$$ac+a^2-b^2-bc=0.$$

$$\therefore\ a^2-b^2+c(a-b)=0,$$

$$\text{or } (a-b)(a+b+c)=0.$$

Hence either $a-b=0$; $\therefore\ a=b$,

or $a+b+c=0$.

(*b*)
$$a^3-b^3+ab(a-b)=m(a^2-b^2),$$

$$\text{or } (a-b)(a^2+ab+b^2)+ab(a-b)=m(a^2-b^2).$$

$$\therefore\ (a-b)\{a^2+2ab+b^2-m(a+b)\}=0,$$

$$\text{or } (a^2-b^2)(a+b-m)=0.$$

Hence either $a^2=b^2$; $\therefore\ a=\pm b$,

or $a+b-m=0$; $\therefore\ a=m-b$.

Ex. 2. (*a*) Extract the square root of

$$x^4-\frac{2}{3}x^3+\frac{19}{9}x^2-\frac{2}{3}x+1.$$

(*b*) Find the value of k for which

$$x^4+8x^3+10x^2+kx+9$$

will be a perfect square. (1901)

(*a*) Using the rule for square root the value required is

$$x^2-\frac{x}{3}+1.$$

(*b*)
$$x^4+8x^3+10x^2+kx+9(x^2+4x-3$$

$$\begin{array}{r|l} x^4 & \\ \hline 2x^2+4x) & 8x^3+10x^2 \\ & 8x^3+16x^2 \\ \hline 2x^2+8x-3) & -6x^2+kx+9 \\ & -6x^2-24x+9 \\ \hline & \end{array}$$

Arranging the work as in the ordinary process of square root, from the last line it is easily seen that the value required is -24.

$$\therefore\ k=-24.$$

Ex. 3. Extract the square root of

$$a^2+a\sqrt{a^2-2}-1. \qquad (1902)$$

This may be written in the form

$$\frac{2a^2+2a\sqrt{a^2-2}-1}{2}.$$

$$\therefore\ \sqrt{\frac{2a^2+2a\sqrt{a^2-2}-1}{2}}=\frac{a+\sqrt{a^2-2}}{\sqrt{2}}.$$

Ex. 4. (*a*) Extract the square root of

$$x^4-2x^3+4x+1-\frac{4}{x}+\frac{4}{x^2}.$$

(*b*) Find the values of p and q for which

$$x^4-2px^3+19x^2-qx+25$$

is a perfect square. (1903)

(*a*) Proceeding as in the preceding case the root is found to be x^2-1+2x^{-1}.

(*b*) The relation is found to be $19-p^2=10$ and $q=10p$.

$$\therefore\ p^2=9 \text{ and } p=3 \text{ or } -3,$$

$$\text{and } q=30 \text{ or } -30.$$

Hence, writing these values in the given expression the square root of

$$x^4-6x^3+19x^2-30x+25 \text{ is } x^2-3x+5.$$

Ex. 5. (*a*) Reduce the following expression to its simplest form :—

$$\frac{a^2}{(a-b)(a+c)}+\frac{b^2}{(b+c)(b-a)}+\frac{c^2}{(c+a)(c+b)}.$$

(*b*) Reduce the following expression to the sum of three squares :—

$$2(a^2+b^2+c^2+bc+ca+ab). \qquad (1902)$$

(*a*) Adding the first two fractions we obtain

$$\frac{a^2(b+c)-b^2(a+c)}{(a-b)(a+c)(b+c)}+\frac{c^2}{(c+a)(c+b)}$$

$$=\frac{ab(a-b)+c^2(a^2-b^2)}{(a-b)(a+c)(b+c)}+\frac{c^2}{(c+a)(c+b)}$$

$$=\frac{(a-b)\{ab+c(a+b)\}}{(a-b)(a+c)(b+c)}+\frac{c^2}{(c+a)(c+b)},$$

or

$$\frac{ab+c(a+b)+c^2}{(a+c)(b+c)}=1.$$

(*b*) The expression when multiplied out becomes

$$2a^2+2b^2+2c^2+2bc+2ac+2ab,$$

or

$$(a^2+2ab+b^2)+(b^2+2bc+c^2)+(c^2+2ac+a^2)$$

$$=(a+b)^2+(b+c)^2+(c+a)^2.$$

Ex. 6. Find the coefficient of x in the quotient, when

$$x^5+p_1x^3+p_2x^4+p_3x^3+p_4x^2+p_5x+p_6$$

is divided by $x-a$. (1904)

The coefficient of x in the quotient is obviously the coefficient of x in

$$[(x^5-a^5)+p_1(x^3-a^3)+p_2(x^4-a^4)+p_3(x^3-a^3)+p_4(x^2-a^2)$$

$$+p_5(x-a)+p_6+(a^5+p_1a^3+p_2a^4+p_3a^3+p_4a^2+p_5a)]\div(x-a).$$

Hence the terms involving x is

$$x(a^4+p_1a^2+p_2a^2+p_3a^2+p_4).$$

Ex. 7. (*a*) If $x=\sqrt{3}+\sqrt{5}$, find, in its simplest surd form, with a rational denominator, the value of

$$\frac{x}{1+x+x^2}.$$

(*b*) Extract the square root of

$$a^2+a\sqrt{(a^2-2)}-1. \qquad (1902)$$

Ex. 8. Reduce the following expressions to their simplest form :—

(*a*) $(a+b+c)^2-(b+c-a)^2-(c+a-b)^2-(a+b-c)^2$.

(*b*) $$\frac{x^2-bc}{(a-b)(a-c)}+\frac{x^2-ca}{(b-c)(b-a)}+\frac{x^2-ab}{(c-a)(c-b)}. \qquad (1902)$$

Ans. (*a*) $24\,abc$; (*b*) -1.

Ex. 9. Find the product of

$$x^{\frac{1}{2}}+1+2x^{-\frac{1}{2}}, \text{ and } x^{\frac{1}{2}}+2+3x^{-\frac{1}{2}}. \qquad (1905)$$

Ans. $x+2x^{\frac{1}{2}}+4x^{\frac{1}{2}}+2+5x^{-\frac{1}{2}}+4x^{-\frac{1}{2}}+6x^{-1}$.

Solve the following equations :—

(*a*) $$\frac{x-1}{3}-\frac{2x-7}{4}=\frac{3}{4}.$$

(*b*) $$\frac{2x+5}{3}=\frac{y+4}{2}=\frac{2x+2y+9}{6};$$

and find the relation between a and b, when

$$\frac{3}{x-a}-\frac{2}{x+a}=\frac{x+b}{x^2-a^2}.$$

Define a mean proportional.

If $a:b::c:d$, show that $\sqrt{abcd}.\{a^2-b^2-c^2+d^2\}$ is a mean proportional to $(ac-bd)^2$ and $(ab-cd)^2$.

PHYSIOGRAPHY.

(STAGES 2 AND 3.)

ENERGY—(*continued*).

ENERGY in one form may be changed into other forms, and the principle of the conservation of energy asserts that for any body or system of bodies left to itself the sum of the various kinds of energy which it may possess remains constant. The various forms of energy may be converted into each other, but provided no energy enters or escapes the total energy remains the same. Let us now consider some of the more important transformations of energy.

Molar kinetic energy becomes changed into molar potential energy when a body is projected upwards. It is changed into electrical energy, and through this into heat when a conductor is moved across a magnetic field, as in the case of a dynamo where a conductor is moved across the lines of force between the poles of a strong magnet. It also becomes changed into kinetic energy of heat and into molecular potential energy when the temperature of a body is raised by friction, percussion, etc., and the body expands.

In frictional electrical machines it is partially converted into the potential energy of electrical separation, the electrification making it harder to drive the machine. There is no very obvious case in which molar kinetic energy is directly converted into energy of radiant heat or light, although it may easily be converted into these indirectly. Neither does any case where molar kinetic energy is converted directly into energy of chemical separation seem to occur.

Molar potential energy is generally only convertible directly into molar kinetic. This change takes place when a body is allowed to fall under the action of gravity, as when a weight is allowed to drop, or a stream of water allowed to flow over a mill-wheel, or a body roll down an incline.

The energy of current electricity is converted into molar kinetic energy in the case of an electric motor, where wires conveying currents attract each other and produce visible motion. It is converted into energy of radiant light and heat, and also into molecular potential energy, when a current flows through a thin wire and makes it hot, and also causes it to expand.

Energy of radiation is changed into kinetic energy of absorbed heat when a body is heated by absorbing rays from the sun or other radiating body. It is also converted into potential energy of electrical separation when light falls upon silver salts.

The kinetic energy of heat and molecular potential energy are converted into molar kinetic and potential energy in the case of a heat engine. They are also changed into electrical energy when thermo-electric currents are produced. A portion is always converted into energy of radiation. They are converted into energy of electrical separation when certain crystals, such as tourmaline, are heated. Many chemical compounds when heated are decomposed, and the energy is converted into potential energy due to chemical affinity.

Energy of electrical separation is converted into molar kinetic energy when two bodies electrified in opposite ways approach each other. It is converted into the energy of current electricity when two oppositely charged bodies are connected by a conductor, or when a spark passes between the two.

The potential energy due to chemical affinity is converted into kinetic energy of heat and molecular potential energy when chemical combination is allowed to take place, as when oxygen and hydrogen combine in the oxy-hydrogen blowpipe flame. It is converted into the energy of current electricity in a circuit where the current is produced by a battery. It is converted into energy of electrical separation when two dissimilar metals are brought into contact.

THE MECHANICAL EQUIVALENT OF HEAT.

A very simple although somewhat crude method of determining the amount of heat corresponding to a known quantity of work is the following experiment, performed by the students going through the regular course of instruction in the Cornell University. The student is instructed to make a pasteboard tube by winding pasted brown paper round a wood cylinder 1 metre long and 7 or 8 centimetres in diameter. The thickness of the

walls of the tube should be about 4 mm. The wooden cylinder is removed from the tube, and the latter suspended in a vertical position to keep it straight until it is dry. A tightly fitting cork is then inserted in one end and secured in position. A quantity of lead shot, whose temperature has been previously determined, and sufficient to fill about one-tenth the length of the tube, is now poured in, and the other cork well fixed in the open end of the tube.

The tube should now be taken by the middle, and placed in a vertical position, with one end on the table. Now quickly rotate the tube in a vertical plane through 180 degrees, and bring the other end down on the table so that the tube becomes inverted with respect to its former position. While the tube was being rotated the pellets remained at the end of the tube, being kept there by centrifugal force. When the rotation ceased, however, the shot fell, and a certain amount of heat was generated. Repeat the operation quickly for about one hundred times. With as little loss of time as possible, pour the shot into a cardboard box, and take its temperature by means of a thermometer. The shot has been heated by the expenditure of energy.

The amount of heat produced is obtained by multiplying together the weight of the shot, the rise in temperature, and the specific heat of the shot.

The energy expended in one motion of the tube is given by the product of the weight of the shot and the distance through which it fell. Multiplying this by the number of times the operation was repeated gives the total amount of work done. Hence it is an easy matter to calculate the amount of work required to produce one unit of heat.

In an experiment of this kind it is best to stick to one system of units throughout, so as to make the calculation easy and avoid mistakes. If the mass of the shot is taken in grams, g should be in dynes, the distances in cms., and the specific heat in calories. The heat produced will then be expressed by the formula

$$s\,m\,t,$$

and the work done by the formula

$$n\,m\,g\,h,$$

where s is the specific heat of the shot, m its mass in grams, and t the rise in temperature; n is the number of times the tube is inverted, g is 981 dynes, and h the height in centimetres through which the shot falls: h is obtained by measuring the distance between the upper surface of the shot and the lower surface of the upper cork when the tube is vertical.

CHEMISTRY.

(ADVANCED AND HONOURS.)

BY C. A. WEST, B.SC., A.R.C.S., F.I.C.

The Conductivity of Electrolytes.

THE molecular conductivity of a solution is found to increase with the dilution, and the increase seems to be least in the cases of salts made up of two univalent ions, greater for salts composed of one bivalent and two monovalent ions, and greater still for those made up of two bivalent ions.

Kohlrausch, by examining a considerable number of cases, was able to arrive at the following conclusion:—

"*The conductivities of the neutral salts are additively composed of two values, one depending only on the metal or positive ion, the other only on the acid radical or negative ion.*"

To a great extent the ions seem to act independently of each other.

The electro-motive force due to the potential differences in the circuit directs the positive ions towards the negative electrode, and the negative ion towards the positive electrode.

The quantity of electricity conveyed in unit time under the influence of unit electro-motive force (or, in other words, the conductivity) depends upon the number of the ions and upon the rate at which they move. We shall now assume (what is approximately true for dilute salt-solutions) that all the molecules of the solute take part in the transference of the electricity across the cell.

Since, according to Faraday's Law, equivalent ions transport equal quantities of electricity, we are able to obtain some information regarding the velocity of the migration of the ions.

On comparing the conductivities of the chloride, bromide, etc., of potassium with the corresponding salts of sodium, we find that the potassium salt has a conductivity of 18 or 19 units greater than that of the corresponding sodium salt. Since the negative ion is the same in each case, the difference must be due to the velocity of the potassium ion being greater than that of the sodium ion. If we deal only with equivalent quantities of different electrolytes, we shall have equal quantities transported by them, and the equivalent conductivity of an ion thus becomes a measure of the velocity of migration of the ion.

As an example, the fact that the conductivity of the potassium ion is 18 or 19 units greater than that of the sodium ion, indicates that the velocity of the potassium ion is 18 or 19 units greater than that of the sodium ion.

The differences in the conductivities, however, only give us the differences in the velocities, and not the actual velocities themselves.

Suppose we have a solution of a salt in a rectangular vessel, which is divided by a porous partition p at the centre, as shown in Fig. 1. P and N are the positive and negative electrodes respectively. The crosses represent the positive ions, and the

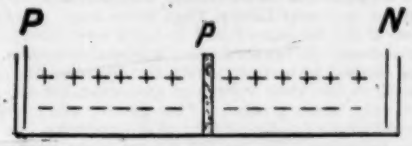

fig. 1.

dashes the negative ions. Before the current is switched on we have equal numbers of each ion in each compartment. When the current commences to flow, the positive ions move to the right and the negative ions move to the left.

If the ions move with equal velocities, then when half the positive ions have been liberated at N, half the negative ions will have been liberated at P; and, moreover, as many positive ions will remain in the left compartment as negative ions in the positive compartment.

The fall in the concentration of the salt remaining will be the same in both compartments. This will be seen on reference to Fig. 2.

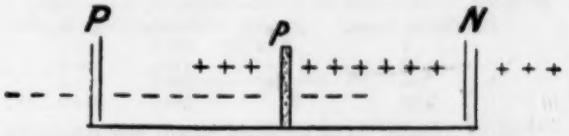

fig. 2.

Each ion without an ion of the opposite kind is supposed to have been liberated. Fig. 3 illustrates the case where the

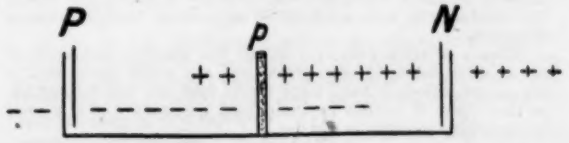

fig. 3.

positive ion moves with twice the velocity of the negative ion. When two-thirds of the positive ions have passed from the left compartment to the right, only one-third of the negative ions have passed from the right compartment to the left.

As many negative ions have been liberated as positive ions, but the concentration of the solution has been decreased twice as much in the left compartment. It will be evident that the difference in the falls in concentration is due to the difference in the two velocities, and that, in fact,

$$\frac{\text{The fall at the cathode}}{\text{The fall at the anode}} = \frac{\text{Speed of the anion}}{\text{Speed of the cation}}.$$

Hence if, after electrolysis, we determine by analysis the falls of the concentration near the two electrodes, the ratio gives us the ratio of velocities of migration of the ions.

We can now determine the parts played by the various ions in the conductivity.

When we electrolyse a solution of potassium chloride, the concentrations near the two electrodes remain almost exactly equal. Hence we are justified in concluding that the potassium and chlorine ions move with equal velocities.

We find that taking $\frac{N}{1000}$ solutions of potassium chloride, sodium chloride, and lithium chloride, their molecular conductivities are 119·3, 100·8, and 92·1 respectively. The conductivity due to the potassium and chlorine ions may therefore be each represented by $\frac{119{\cdot}3}{2}$, or 59·7. Hence we may, for purposes of comparison, represent their velocities by 59·7 units. Adopting this plan, it is clear that the velocity of the sodium ion will be represented by 100·8 – 59·7, or 41·1, and that of the lithium ion by 92·1 – 59·7, or 32·4.

We can then, by determining the ratio of transport for potassium chloride, calculate the comparative velocities of all the ions if we know their conductivities; or we may proceed backwards if we know the conductivities, and calculate the ratios of transport of any salts formed from these ions. Actual determinations of the ratios are found to agree very closely with the calculated ones. So far we have considered only salts. When we come to deal with strong acids, like hydrochloric acid and nitric acid, we find their behaviour analogous, but the conductivity is very much greater. This greater conductivity can only be due to the greater velocity of the hydrogen ion.

In the following table are the figures given by Kohlrausch for the equivalent conductivities of a number of acids at a dilution of 1000 litres:—

HCl.	HNO_3.	$\frac{1}{2}H_2SO_4$.	$\frac{1}{3}H_3PO_4$.	$C_2H_4O_2$.
345·5	312·7	331·6	96·8	38

Taking the velocity of chlorine as 59·7, the velocity of hydrogen is 345·5 – 59·7, or 285·8, or approximately five times that of potassium, 59·7.

This great velocity necessarily produces great changes of concentration at the electrodes. The changes have been estimated by analysis and found to agree with the calculated values, thus supporting the view of the independent motion of the ions.

Kohlrausch has determined the conductivities of the alkalies, and gives the following figures for solutions at a temperature of 18° C.

Dilution in Litres.	NH_4OH.	NaOH.	KOH.
1	0·84	149·0	171·8
10	3·1	170·0	198·6
100	9·2	187·0	212·4
1000	26·0	188·0	214·0

Taking the figure 214 for potassium hydrate, and subtracting 59·7 for the potassium, we get 214 – 59·7, or 154·3, for the velocity of the hydroxyl ion OH, which is more than twice that of the negative ion chlorine.

Up to the present we have assumed that the whole of the solute has been broken up into its ions. We, however, get a number of cases where the conductivity is small, and where the conductivity does not cease to increase at easily attainable dilutions.

When a solution gets very dilute the specific resistance of the solution becomes very great, and any slight impurities in the water introduce very large errors into the determinations, so that there is a limit beyond which no useful end is served by carrying the dilution further.

In such cases we cannot determine directly the maximum conductivity or any near approach to it. We may, however, arrive at the value of the conductivity which the substance would have at infinite dilution in the following manner:—

Suppose the acid is acetic acid. Sodium acetate in solution breaks up almost entirely into its ions, and if we determine its conductivity at 1000l. or 10,000l. dilution, and subtract from this figure the conductivity of the sodium ion 41·1, we get the velocity of the negative ion. If to this we add the velocity of the hydrogen ion, we obtain the conductivity of acetic acid at infinite dilution.

There seems little doubt that the low conductivities of such substances as ammonia and phosphoric acid, as well as most organic acids and bases and weak acids and bases generally, are due to the fact that the molecules of these substances, when dissolved, do not break up to any great extent into their ions. When we remember that it is only the free ions that play any part in conveying the electricity through the solution, we can understand the low conductivity.

We have other methods of finding whether a substance is wholly dissociated or not. If we determine the depression of the freezing-point of a solvent produced by a good conductor, such as hydrochloric acid or potassium chloride, we find that we get figures very much higher than would be expected from the molecular weight—in fact, with either of the substances mentioned the figure is practically twice that calculated from the molecular weight, showing that the substance is almost wholly dissociated into its ions. A bad conductor, however, like acetic acid, gives figures agreeing fairly closely with those calculated from the atomic weight, thus supporting the view that very few of the molecules are broken up into ions.

Representing the conductivity at infinite dilution by μ_∞, and the velocities of migration of the positive and negative ions by u and v respectively, we have

$$\mu_\infty = u + v.$$

With strong acids and bases or salts containing a strong acid radical or a strong basic radical, the dissociation may be assumed to be practically complete at a dilution of 1000 or 10,000 litres.

To put the expression in a general form for all dilutions, we may write it

$$\mu = x(u + v),$$

where x represents the fraction of the substance which has been dissociated into ions.

When we know the conductivity of a substance at infinite dilution, and also its conductivity at any other dilution, we can calculate the *degree of electrolytic dissociation*, or the fraction x of the substance which is dissociated into ions, from the two equations

$$\mu = x(u + v),$$

$$\mu_\infty = u + v;$$

$$\text{for } x = \frac{\mu_\infty}{\mu}.$$

We may, therefore, state generally that *The degree of dissociation of a dissolved electrolyte at any dilution is equal to the ratio of the molecular conductivity of the solution at this dilution to the molecular conductivity at infinite dilution.*

NOTES ON PHYSICS.

BY EDWIN EDSER, A.R.C.SC.

Author of "Heat for Advanced Students," "Light for Students," "Differential and Integral Calculus for Beginners," etc.

Electricity and Magnetism.

What is meant by the expression "the dimensions of a physical quantity"?

Taking as your fundamental quantities time, length, and force, deduce the dimensions of energy and electrostatic potential.

London University, B.Sc. Pass, 1905.

All physical quantities must be measured in terms of certain fundamental units, and therefore the numerical magnitude of a physical quantity will depend on the fundamental units selected. A mathematical expression showing the manner in which the fundamental units enter into the magnitude of a physical quantity is said to express the "dimensions" of that quantity. In other words, the dimensions of a physical quantity show us how a measurement of that quantity depends on the fundamental units selected.

The fundamental law of electrostatics is that the force f exerted by one charge on another varies directly as the product of the two charges q_1 and q_2, and inversely as the square of the distance d separating them. Thus by selecting the unit charge, so that it exerts unit force on a similar charge placed at unit distance, we obtain the equation—

$$f = \frac{q_1 q_2}{d^2}.$$

Let Q denote the dimensions of unit charge, the fundamental units being time T, length L, and force F; then we have from the above equation

$$F=\frac{Q^2}{L^2}.$$

$$\therefore Q=LF^{\frac{1}{2}}.$$

The potential at a distance r from a charge q is equal to $\frac{q}{r}$; hence if P denotes the dimensions of potential, we have

$$P=\frac{Q}{L}=\frac{LF^{\frac{1}{2}}}{L}=F^{\frac{1}{2}}.$$

The kinetic energy communicated to a body is equal to the work done by the force which sets the body in motion, and is measured by the product of the force into the distance through which it acts; thus the dimensions of energy = FL.

It can be proved that the energy of a charge is equal to half the product of the charge into the potential to which it is raised; hence

$$PQ=F^{\frac{1}{2}}\times LF^{\frac{1}{2}}=LF,$$

as should be the case.

Define electrical resistance, and explain how it happens that when electrical resistance is expressed on the electro-magnetic or on the electrostatic system of units, it is in one case of the dimensions of a velocity and in the other of a slowness.

London University, B.Sc. Pass, 1906.

When an electric current flows through a wire, heat is produced in the latter. Since heat can only be produced at the expense of energy which is dissipated, it follows that the electric current loses energy as it flows through the wire. The difference of potential V between the ends of the wire is defined as the energy dissipated per unit current per unit time, or

$$V=\frac{W}{Ct}$$

if W is the energy dissipated in the wire during a time t by a current C.

If a metallic conductor is kept at a constant temperature, while various currents are sent through it, and the difference of potential produced by each current is determined, then it is found that the *difference of potential is proportional to the current*, or

$\frac{V}{C}$ = a constant, which is called the *resistance* of the wire at the given temperature. This is Ohm's law in its most general form.

Hence it follows that the dimensions of a resistance are found by dividing the dimensions of a difference of potential by those of a current.

Electro-magnetic System.

Dimensions of Magnetic Pole Strength.—The force exerted by one magnetic pole on another is equal to the product of the strength of the poles divided by the square of the distance separating them. Taking as our fundamental units length (L) mass (M) and time (T), it is easily proved that the dimensions of a force are given by the expression

$$\frac{ML}{T^2}.$$

Let the dimensions of pole strength be denoted by P. Then

$$\frac{ML}{T^2}=\frac{P^2}{L^2}$$

$$\therefore P=L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}.$$

Magnetic Field.—The magnetic field (force per unit pole) in the neighbourhood of a given magnetic pole is equal to the strength of the pole divided by the square of its distance from the point in question. Hence the dimensions F of a magnetic field are obtained by dividing the dimensions of a pole by the square of a length, so that

$$F=L^{-\frac{1}{2}}M^{\frac{1}{2}}T^{-1}.$$

Electric Current.—The magnetic field at the centre of a circular turn of wire, carrying a given electric current, is equal to the product of the current into the length of the turn of wire divided by the square of the radius of the turn. Hence if C denotes the dimensions of a current

$$L^{-\frac{1}{2}}M^{\frac{1}{2}}T^{-1}=\frac{CL}{L^2}.$$

$$\therefore C=L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}.$$

Difference of Potential.—The dimension V of a difference of potential are found by dividing the dimensions of energy by those of current and time. Energy has the dimensions of a force multiplied by a length (or the product of a mass into the square of a velocity), so that they are given by

$$\frac{ML^2}{T^2}.$$

Hence

$$V=\frac{\frac{ML^2}{T^2}}{L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}\times T}=L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-2}.$$

Resistance.—The dimensions R of a resistance are obtained by dividing those of a difference of potential by those of a current, so that

$$R=\frac{V}{C}=\frac{L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-2}}{L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}}=\frac{L}{T}.$$

Thus in the electro-magnetic system the dimensions of a resistance are a length divided by a time, which are the same as those of a velocity.

Electrostatic System.

Electric Charge.—Let Q be the dimensions of an electric charge on the electrostatic system. Then, by reasoning similar to that used with relation to magnetic pole strength

$$\frac{ML}{T^2}=\frac{Q^2}{L^2}.$$

$$\therefore Q=L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-1}.$$

Electric Current.—The electric current is the charge which passes a given point in unit time, so that its dimensions are given by the equation

$$C=\frac{Q}{T}=L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-2}.$$

Difference of Potential.—Divide the dimensions of energy by those of current and time

$$V=\frac{\frac{ML^2}{T^2}}{L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-2}\times T}=L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}.$$

The same result can be obtained by dividing the dimensions of a charge by a length; this is consistent with the fact that the potential at a distance r from a charge q is equal to $\frac{q}{r}$.

Resistance.—

$$R=\frac{V}{C}=\frac{L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}}{L^{\frac{3}{2}}M^{\frac{1}{2}}T^{-2}}=\frac{T}{L}.$$

Hence on the electrostatic system the dimensions of a resistance are equal to a time divided by a length, or the inverse of a velocity. In other words, the electrostatic dimensions of a resistance are the same as those of the time taken to move over unit distance, or of a slowness.

Mr. Augustine Birrell is to edit the volume of Browning's poems in Messrs. Jack's forthcoming *Golden Poets*. The volumes, of which six will appear during the present year, will present several interesting features, such, for instance, as the inclusion of a series of dainty coloured plates—an entire novelty in this class of book. The Notes and Introductions are all by well-known writers, such, for example, as Mr. W. B. Yeats (Spenser), Mr. A. C. Benson (Whittier), Professor Dowden (Coleridge), Professor Saintsbury (Longfellow), Professor MacNeile Dixon (Wordsworth), Canon Beeching (Herrick), Mr. Charles Whibley (Byron), Mr. Arthur Symons (Keats), Professor J. Churton Collins (Shelley). The artists will include such names as Edmund Sullivan, Jessie B. King, Mrs. Stanhope Forbes, Charles Pears, and Gilbert James. Mr. Oliphant Smeaton is the general editor of the Series.

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3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

Una.—Let AC, BD, and EF be the diagonals of a complete quadrilateral, and let AC, BD meet in G. Join EG and produce it to meet BC in H. Prove that B, H, C, F is a harmonic range. (*Note.*—Solution to be based on Euclid VI., 1–4.)

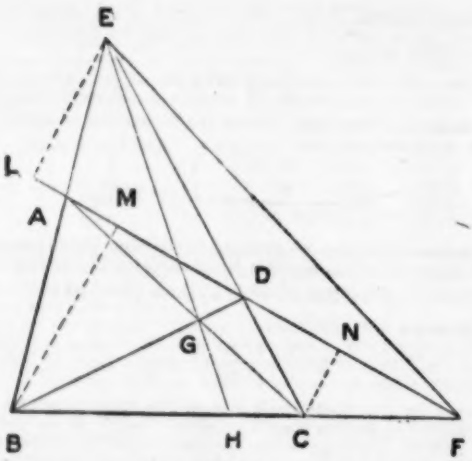

FIG. 1.

Referring to Fig. 1 we have by Euclid VI., 1—

$$\frac{\Delta EGB}{\Delta BGH}=\frac{EG}{GH}=\frac{\Delta EGC}{\Delta CGH};$$

$$\therefore \frac{\Delta EGB}{\Delta EGC}=\frac{\Delta BGH}{\Delta CGH}.$$

But $$\frac{\Delta BGH}{\Delta CGH}=\frac{BH}{HC};$$

$$\therefore \frac{BH}{HC}=\frac{\Delta EGB}{\Delta EGC}.$$

Similarly $$\frac{CD}{DE}=\frac{\Delta BGC}{\Delta BGE},$$

and $$\frac{EA}{AB}=\frac{\Delta CGE}{\Delta CGB};$$

$$\therefore \frac{BH}{HC}\cdot\frac{CD}{DE}\cdot\frac{EA}{AB}=1.$$

(This result is known as Ceva's Theorem.)

Drawing EL, BM, CN perpendiculars from E, B, C on AF, we have by Euclid VI., 4—

$$\frac{EA}{AB}=\frac{EL}{BM},\ \frac{BF}{FC}=\frac{BM}{CN},\ \frac{CD}{DE}=\frac{CN}{EL};$$

$$\therefore \frac{EA}{AB}\cdot\frac{BF}{FC}\cdot\frac{CD}{DE}=\frac{EL}{BM}\cdot\frac{BM}{CN}\cdot\frac{CN}{EL}=1,$$

(This result is known as Menelaus' Theorem.)

Hence we have

$$\frac{BH}{HC}\cdot\frac{CD}{DE}\cdot\frac{EA}{AB}=\frac{EA}{AB}\cdot\frac{BF}{FC}\cdot\frac{CD}{DE};$$

$$\therefore \frac{BF}{FC}=\frac{BH}{HC},$$

that is BF : FC :: BH : HC.

Hence by definition B, H, C, F is a harmonic range.

Scamp.—Eliminate x, y and z from the following equations:—

$$x^2+y^2=2ayz;\ z^2+x^2=2bzx;\ x^2+y^2=2cxy.$$

(*Algebraical Exercises.* Jones and Cheyne.)

Dividing the first of the given equations by yz, the second by zx, and the third by xy, we obtain the equations

$$\frac{x}{y}+\frac{y}{z}=2a;\ \frac{z}{x}+\frac{x}{z}=2b;\ \frac{x}{y}+\frac{y}{x}=2c.$$

Multiplying together these three equations we find

$$\frac{x^2}{y^2}+\frac{y^2}{x^2}+\frac{z^2}{x^2}+\frac{x^2}{z^2}+\frac{y^2}{z^2}+\frac{z^2}{y^2}+2=8abc. \quad \ldots \quad (1)$$

But $$\left(\frac{x}{y}+\frac{y}{z}\right)^2=4a^2;$$

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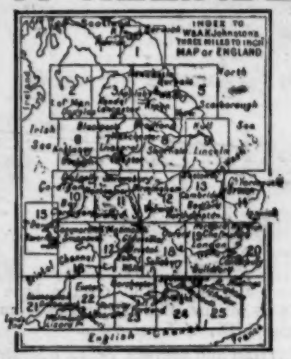

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$$\therefore \frac{z^2}{y^2}+2+\frac{y^2}{z^2}=4a^2;$$

$$\therefore \frac{z^2}{y^2}+\frac{y^2}{z^2}=4a^2-2.$$

Similarly $\frac{x^2}{z^2}+\frac{z^2}{x^2}=4b^2-2$,

and $\frac{x^2}{y^2}+\frac{y^2}{x^2}=4c^2-2$.

Substituting in (1) we obtain

$$4(a^2+b^2+c^2)-6+2=8abc.$$

Hence $$a^2+b^2+c^2-2abc-1=0.$$

Darcy.—ABC is an isosceles triangle, and on the base or base produced any point X is taken. Show that the circumscribed circles of the triangles ABX, ACX are equal.

(Hall and Stevens' *School Geometry.*)

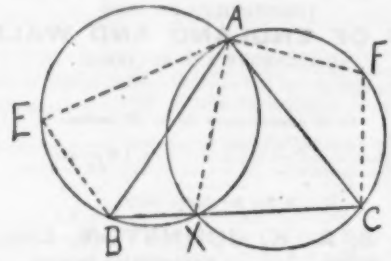

FIG. 2.

Because AEBX is a cyclic quadrilateral, therefore AEB, AXB are together equal to two right angles. But AXB, AXC are together equal to two right angles. Therefore the angle AXC is equal to the angle AEB. Hence the segments AXC, AEB are similar segments; and their chords AC, AB are equal; therefore the segment AXC is equal to the segment AEB. Similarly it may be proved that the segment AXB is equal to the segment AFC. Therefore the whole circle AXBE is equal to the whole circle AXCF.

X. Y. Z.—Sum the series

$$\cos\theta+\cos 2\theta+\ \ldots\ +\cos n\theta,$$

and prove that if $13\theta=2\pi$, then

$$4(\cos\theta+\cos 3\theta+\cos 9\theta)(\cos 2\theta+\cos 6\theta+\cos 18\theta)+3=0.$$

In any standard treatise on trigonometry it is shown that

$$\cos\alpha+\cos(\alpha+\beta)+\cos(\alpha+2\beta)+\ \ldots\ +\cos\{\alpha+(n-1)\beta\}$$

$$=\frac{\cos\left(\alpha+\frac{n-1}{2}\beta\right)\sin\frac{n\beta}{2}}{\sin\frac{\beta}{2}} \quad \ldots\ (1)$$

Writing $\alpha=\beta=\theta$ we have

$$\cos\theta+\cos 2\theta+\cos 3\theta+\ \ldots\ +\cos n\theta$$

$$=\frac{\cos\frac{n+1}{2}\theta\sin\frac{n\theta}{2}}{\sin\frac{\theta}{2}} \quad \ldots\ (2)$$

Hence when $n\theta=2\pi$ the sum of the terms on the left-hand side of (2) is zero . . . . . (3)

If $13\theta=2\pi$, it is easily seen that

$$\cos 9\theta=\cos 4\theta, \text{ and that } \cos 18\theta=\cos 8\theta.$$

Hence $$4(\cos\theta+\cos 3\theta+\cos 9\theta)(\cos 2\theta+\cos 6\theta+\cos 18\theta)+3$$

$$=4(\cos\theta+\cos 3\theta+\cos 4\theta)(\cos 2\theta+\cos 6\theta+\cos 8\theta)+3$$

$$=4\left[\begin{array}{l}\cos 2\theta\cos\theta+\cos 6\theta\cos\theta+\cos 8\theta\cos\theta\\+\cos 3\theta\cos 2\theta+\cos 6\theta\cos 3\theta+\cos 8\theta\cos 3\theta\\+\cos 4\theta\cos 2\theta+\cos 6\theta\cos 4\theta+\cos 8\theta\cos 4\theta\end{array}\right]+3$$

$$=2\left[\begin{array}{l}\cos\theta+\cos 3\theta+\cos 5\theta+\cos 7\theta+\cos 7\theta+\cos 9\theta\\+\cos\theta+\cos 5\theta+\cos 3\theta+\cos 9\theta+\cos 5\theta+\cos 11\theta\\+\cos 2\theta+\cos 6\theta+\cos 2\theta+\cos 10\theta+\cos 4\theta+\cos 12\theta\end{array}\right]+3$$

$$=2\left[\begin{array}{llll}\cos\theta+\cos 2\theta+\cos 3\theta+\cos 4\theta+\cos 5\theta+\cos 6\theta+\cos 7\theta\\+\cos 8\theta+\cos 9\theta+\cos 10\theta+\cos 11\theta+\cos 12\theta+\cos 13\theta\\-\cos 8\theta+\cos 2\theta & +\cos 5\theta & -\cos 13\theta\\+\cos\theta+\cos 3\theta+\cos 5\theta+\cos 7\theta+\cos 9\theta\end{array}\right]+3 \quad \ldots\ (4)$$

Since $13\theta=2\pi$, then by (3) the sum of the first thirteen terms is zero.

Also $$\cos 5\theta-\cos 8\theta=2\sin\frac{13\theta}{2}\sin\frac{3\theta}{2},$$

and this is zero when $13\theta=2\pi$.

Again $$\cos 13\theta=1 \text{ when } 13\theta=2\pi.$$

Lastly, $$\cos\theta+\cos 3\theta+\ \ldots\ +\cos 9\theta=\frac{\cos(\theta+4\theta)\sin 5\theta}{\sin\theta}$$

$$=\frac{\sin 10\theta}{2\sin\theta}=\frac{-\sin 3\theta}{2\sin\theta}, \text{ when } 13\theta=2\pi.$$

Hence (4) reduces to

$$2\left[\frac{-\sin 3\theta}{2\sin\theta}+\cos 2\theta-1\right]+3$$

$$=2\left[-\frac{3}{2}+2\sin^2\theta+1-2\sin^2\theta-1\right]+3$$

$$= \quad -3+3 \quad =0.$$

Therefore

$$4(\cos\theta+\cos 3\theta+\cos 9\theta)(\cos 2\theta+\cos 6\theta+\cos 18\theta)+3=0,$$

when $13\theta=2\pi$.

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Stories of Animals. By M. T. Yates, LL.D. Though the book can scarcely claim to be of great educational value, in the miscellaneous collection of narratives which it contains there is plenty of healthy, entertaining reading matter for the children. The photos of the birds' nests are excellent. No price given.

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The Student's Hygiene. By Ernest Evans. In the introductory chapter, Mr. Evans emphasises the vital importance of a knowledge of hygiene, and points out that it is intimately related to many other sciences. Two courses were then open to him. One was to strictly confine himself to hygiene, assuming that the student could get instruction in the subsidiary subjects; the other was to assume nothing, but to start *ab initio* and put in sections dealing with these sciences. Mr. Evans has chosen the latter and more dangerous course, and as a result his book contains mistakes which can only be regretted, in view of the time and trouble evidently spent in preparation. To point out only a few. Experiments 3*d*, 25, and 125, 5 we found unworkable; 28*b* is very ambiguous; the statements about the composition of fat on pages 17 and 18 are quite inconsistent; and the statement that free chlorine occurs in drinking water is wrong. Pancreatic juice is said to contain trypsin, notwithstanding much recent work to the contrary; 6·5 per cent. of fat is stated to render pork indigestible, yet the digestible herring is said to contain 10 per cent. and yolk of egg 26 per cent. But when we come to the main subject the treatment is very good, and we only wish that more space had been given to hygiene, and less to other matters.

UNIVERSITY TUTORIAL PRESS, LTD., 157 DRURY LANE, W.C.

The Elements of the Duties and Rights of Citizenship. By W. D. Aston, B.A., LL.B. The works issued by this firm enjoy a deservedly high reputation. This book is intended primarily for use in preparing for the Preliminary Certificate Examination. It is written by one who evidently knows the subject well. The style is always clear, and references are frequently made to well-known standard works. Altogether, it is a book we can heartily recommend.

Outlines of English History. By Ince and Gilbert. In the study of history there is much memory work, and the use of some such book as this is almost imperative. This one is very suitable for its purpose, for it is full of facts, and the grouping of those facts is such as to aid the memory. It is now in its 651st thousand—an eloquent testimony to its usefulness. It has been thoroughly revised.

THE WELSH EDUCATIONAL PUBLISHING CO., MERTHYR TYDFIL.

Flame-Bearers of Welsh History. By Owen Rhoscomyl. We cannot imagine any boy, English or Welsh, reading this book without a great amount of pleasure. Wales has produced many heroes, and their story is here told in an easy and eloquent style. The writer deals with such celebrities as Caradoc, Cadwallon, and Glyndwr, ending naturally with Henry Tudor. The book is one to be heartily commended and widely used.

The Story of England and Wales (Anglo-Welsh Historical Readers). By John Finnemore. The idea of the author has been to give the story of this land, but to give special prominence to Welsh history. Thus, after treating of Alfred the Great he writes of Howel the Good. While useful in English schools, the book should be particularly acceptable in those of Wales. The type is singularly clear, the illustrations numerous, and the binding strong.

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A Text-Book of Botany. Part I. By M. Yates. This book is intended for the use of students who are preparing for the usual examinations, and is, we think, as exhaustive as needs be. It is thoroughly well illustrated, and the special points to be noted as the lessons proceed are clearly arranged and explained. There is a good index, and also a useful set of examination questions.

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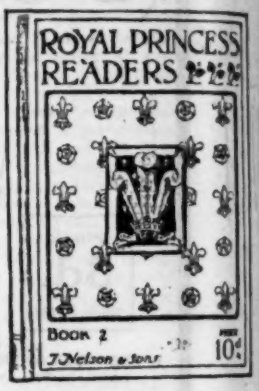

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